Adolescent suicide

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Purpose of review
The present review summarizes the updated literature on adolescent suicide.
Recent findings
Reductions in youth suicide rates are probably related to use of selective serotonin reuptake inhibitors since the mid 1990s as well as restrictions in means and enhanced pesticide control. The serotonin theory of suicide has received more empirical support. Familial transmission of suicidal behavior may be mediated by transmission of impulsive aggression from parent to child and early detection of precursors of suicidal behavior can help identify families at high risk of having a suicidal child. A newly investigated social risk factor of bullying adolescents and the novel psychological construct of autobiographical memory all help to advance our understanding and treatment of suicidal youths. Much effort is needed in establishing more solid empirical evidence for suicide prevention programs and treatment, while assessment tools are still in desperate need of further development.
Summary
Suicidal behavior remains an important clinical problem and a major cause of death in youth. There are key issues that need to be solved for better prediction of suicidality, prevention and treatment of youth suicide.

Keywords
adolescent, prevention, risk factors, suicide, treatment

Introduction

Adolescent suicide is a complex topic, which can be approached from many different angles. In the present article, we have attempted to summarize the following areas: definitions of the different forms of suicidal behaviors and the relationships between them; epidemiology; biological risk factors; psychological risk factors; social risk factors; assessment; treatment and prevention.

Definitions of suicidal behaviors

Suicidal behavior is probably a set of noncontinuous and heterogeneous spectra of behaviors. Thus, suicidal ideation, suicidal threats, gestures, self-cutting, low lethal suicide attempts, interrupted suicide attempts and near fatal suicide attempts and actual suicide may or may not be related to each other, depending on the context in which they are studied [1]. In a recent article, Apter et al. [2•] showed that in a military context, these behaviors can have very different meanings.

Often authors do not differentiate between different forms of behaviors and especially in the UK, the terms parasuicide and deliberate self-harm (DSH) have been used as catchall categories. This semantic confusion is troublesome as especially in biological research description of the phenotype can be critical. Moreover, preventive methods may be different for the different subtypes of suicidal behaviors in adolescents.

Epidemiology of suicide in youth: recent changes

The epidemiology of adolescent suicide has shown striking changes over the last 100 years. Since the beginning of the 20th century, there has been a steady rise in the incidence of suicide in young men punctuated by decreases during the 1st and 2nd World Wars. This rise became much more marked in the 1960s and peaked in the middle of the 1990s. Since the 1990s rates of suicide in young men have declined steadily and by 2005 in Britain and 2003 in the USA they were at their lowest level ever for almost 30 years. According to Biddle et al. [3••], this decline was partly because of reduction in poisoning from car exhaust gas due to increased number of cars with catalytic converters. Nonetheless, there has been a decline in suicide from all methods, including

hanging, suggesting a more pervasive effect. In England and Wales, there has also been reduction in some of the risk factors for suicide, including reduction in unemployment and divorce [3••]. Another controversial explanation put forward to explain this reduction in suicide rates was the increased use of antidepressants, especially selective serotonin reuptake inhibitors (SSRIs) in the adolescent population. In their analysis, Biddle *et al.* [3••] refute this claim; however, US authors have strongly supported the important role of SSRI use introduced in the 1980s in explaining the reduction in the rate of adolescent suicide [4••]. They point out that similar trends of suicide reduction have been shown in the United States and the Netherlands [4••]. Between 2003 and 2005, the youth suicide in the Netherlands increased by 49% and in the United States by 14% [4••], following the issuing of public health warnings about the possible association between antidepressant use and suicide ideation by both US and European regulators. Following these proclamations, the rate of prescribing SSRI for adolescents was reduced by approximately 22% in the United States and the Netherlands. Thus, Gibbons *et al.* [4••] together with others [5,6] have strongly advocated the theory that it was the reduction in use of SSRIs that led to the increase in youth suicide. In contradistinction, Wheeler *et al.* [7•] analyzed the population impact on the incidence of suicide and non-fatal self-harm of regulatory action in 2003 to restrict the use of SSRIs in individuals under the age of 18 and came to the opposite conclusion that in England reductions in antidepressant use have not led to an increase in suicidal behavior.

The controversy continues, though the authors of this article tend to accept the conclusion that restricted use of SSRIs and the black box label warnings in the United States and Europe are problematic.

One other major epidemiological finding in recent years has been the differences in youth suicide in Asian versus Western countries. It appears that in China, southern India and Singapore, the sex differences for suicide are reversed and that young women are more at risk for suicide than men [8]. In these young women, the suicide appears to be related to impulsive attempts using pesticides as the mode of attempt [9,10•,11•]. The high fatality may be related to the lack of emergency medical facilities [9]. Mental illness seems to be less of a factor in these suicides than has been reported in the West [10•,11•]. Undoubtedly, the restriction in the use of pesticides is a very important preventive measure in these areas [12••]. However, these findings may have important theoretical implications. Many clinicians look upon overdoses by female adolescents as being demonstrative, manipulative or a cry for help. In fact, this was in some part the reason for adopting the term parasuicide.

In the Asian context, it seems that these impulsive attempts continue to occur despite the obvious lethal outcome. It is interesting to note that female youth suicide rates have remained fairly constant in the West, while increasing in the Asian countries where there were no pesticide restrictions.

Biological risk factors

Family genetic studies have an important role to play in understanding youth suicide. Suicidal behavior is highly familial and heritable as well. Twin and adoption studies have shown that both completed and attempted suicide form part of a clinical phenotype that is familiarly transmitted. Thus, suicide attempt rates are elevated in the families of suicide completers and suicide rates are elevated in family members of attempters [13]. This is so even after adjusting for the presence of psychiatric disorders in the proband and family, indicating that youth suicide is inherited distinctively from the psychiatric illness [13]. It is possible that impulsive aggression is the basic psychological dimension that is passed on [14•]. The biological mechanism that may be involved is probably related to serotonin metabolism and low turn over of 5-hydroxyindoleacetic acid (5HIAA) as measured in the cerebral spinal fluid [15••].

Social risk factors

Brent and Melhem [14•] have recently reviewed some of the nongenetic factors contributing to the risk of familial transmission of suicidal behavior. These include also social factors such as parental separation, divorce and family discord as well as child abuse [16•] and imitation [17].

Other risk factors for depression and suicidal behavior in adolescents put into focus these last few years include bullying [18] and peer victimization [19•], which seem to be a common problem in children and adolescents, with approximately 10–20% of US high school students reporting moderate-to-frequent victimization and 13% reporting bullying others. Findings indicate that both victims and bullies are at high risk for suicide and that the most troubled adolescents are those who are both victims and bullies [18].

The influence of media reporting on suicide in the young has been widely researched over the last few decades, while the impact of the Internet is less well understood [20]. As an increasingly popular source of information, concerns have been raised about the existence of sites that promote suicide [20,21] as well as suicide sites claimed to have facilitated suicide pacts among strangers [22]. However, empirical research is needed to support these notions.

Alcohol and drug use has been reported to be associated with suicidal behavior in adolescents [23[•]]. Two recent studies focused on the problem of binge drinking, a most common pattern of alcohol consumption among high school [24] and college youths [23[•]], found it to be strongly associated with suicidal ideation and behavior.

Psychological risk factors

Some newly investigated psychological risk factors of suicide in adolescents include the assessment of Williams' theory on suicidality and autobiographical memories. Williams [25] suggested that suicidal individuals lack the cognitive ability to retrieve specific autobiographical memories and rather produce more general memories. This means that they will not remember specific events in their lives such as, 'I remember when my dog died and I was very sad', and instead remember having a dog. This leaves them a much smaller repertoire of experience to draw upon and, thus, fewer and less effective available solutions when faced with interpersonal problems [26[•]].

Ariee et al. [26[•]] have supported Williams' [25] notion that generalized autobiographical memory is associated with deficits in interpersonal problem solving, negative life events, hopelessness, and suicidal behavior.

Another study showed that deficits in reflection in depressed suicidal individuals is linked to suicidality, probably also through its relation to problem solving deficits [27]. Adding to these, a third study on cognitive characteristics in suicidal adolescents found that poor decision-making is present in adolescents who currently self-harm but not in those with previous history. Hence, improvement in decision-making skills may, therefore, be linked to cessation of self-harm [28[•]].

Aggression and impulsivity are traits highly related to suicidal behavior in adolescents. Higher levels of impulsive aggressiveness play a greater role in suicide among younger individuals, with decreasing importance with increasing age [29]. Another finding is that aggression may have a role in worsening other suicide risk factors and potentiating suicide attempt [30[•]]. This finding is consistent with the hypothesis of Brent and Mann [13] that aggression may mark a dispositional tendency to act impulsively in states of negative effect and may in some individuals facilitate acting upon suicidal thoughts. Melhem et al. [31[••]] emphasize that familial transmission of suicidal behavior appears to be mediated by the transmission of impulsive aggression from parent to child. In their prospective study, they found that precursors of early-onset suicidal behavior in offspring of parents with mood disorders include mood disorder and

impulsive aggression as well as parental history of suicide attempt, sexual abuse, and self-reported depression. This first report of precursors of suicidal behavior may help to identify families at very high risk of having a child with suicidal behavior and frames targets for prevention and treatment [31[••]].

Additional potential contributions to suicidal behavior in depressed adolescents are other early defined traits such as temperament and emotional regulation. One study [32] suggests that suicidal youth are characterized by high maladaptive regulatory responses and low adaptive emotional regulation responses to dysphoria.

Eating disorders are widespread among adolescents and these individuals have high rates of suicidal behavior [33]. This appears to be related primarily to depression and aggression, which are also common in these individuals [34]. A clinical sample of both adolescents and adults with current or lifetime diagnosis of anorexia nervosa showed that suicide attempts are frequent occurrences, are often severe and are associated with the intention to die. After controlling for depression, an association was found with behavioral and effective lack of control, including impulsivity [35[•]].

Hence, impulsivity and aggression seem to play an important role in the pathways to suicidality as precursors of suicidal behavior and as possible mediators between other disorders and suicidality.

Another important risk factor for suicidality is insight (awareness into illness, of the need for treatment and of the consequences of the disorder) [36], which has mostly been investigated in psychotic disorders. One study [37] found that the adolescent patients with better insight and, thus, probably with better prognosis are more likely to be depressed and suicidal. To our knowledge, this subject is in urgent need of further research, as it has not been investigated specifically in adolescents. This is so even though insight into schizophrenia is possibly greater in younger patients [38] and the risk of suicide is three times higher in the young compared with adult schizophrenic patients [39].

Assessment

Although there are self-report instruments assessing the presence of suicidality as well as risk factors, there are still major problems in objective assessment of suicidal adolescents. Even though the principles of clinical assessment are well known and used by clinicians all over the world, an objective orthogonal assessment scale is still problematic. This reflects the difficulties described in the introduction of definitions. For instance, are suicidal gestures more serious than suicidal ideation? Is a low

lethal suicide attempt more serious than a suicidal gesture? As these issues are not clear, a scale of suicidal seriousness from 1 to 10 is not feasible. The only recent publication to deal with this problem is a study by Posner et al. [40••], describing the Columbia Classification Algorithm for Suicide Assessment (C-CASA). This is a standardized suicidal rating system providing data for the pediatric suicidal risk analysis of antidepressants conducted by the Food and Drug Administration (FDA). The lack of such a scale has in our opinion severely impeded the progress of research in suicide in adolescents, as most of the scales in use do not take these factors into consideration.

Treatment

There is little research on treatment for suicidal adolescents and as far as we know, there have not been any publications on this topic, which are worthy of mention. At present, there is one National Institute of Mental Health (NIMH) funded study underway that should go far to rectify this lack [see Treatment of Adolescent Suicide Attempters (TASA)]. On the contrary, there has been tremendous advancement in the treatment of adolescent depression and many studies have assessed the use of cognitive behavior therapy (CBT), interpersonal psychotherapy (IPT) and medications, providing many articles of importance [41–44].

DBT (dialectical behavior therapy) is another treatment adopted for suicidal behavior in adolescents specifically [45] but as far as we could determine, there have been no recent articles on this topic. As mentioned earlier, there have been many studies on the use of antidepressant medication either alone or in combination with psychotherapy for depression [41,42,46,47]. None of these studies has addressed suicidality as the main object of therapy, though, as stated above, there has been much discussion about the potentiating effects of these drugs on suicide. Only one medication has been shown to have a potential antisuicide effect, that is, lithium [48,49]. Apart from one report describing the preventive effects of lithium on suicidal thoughts and behaviors in adolescents [50], there have been no studies on the effects of this treatment on adolescent suicidal behavior.

Prevention programs

The suicide prevention and national prevention programs have become increasingly in vogue – for a recent review see Mann et al. [51]. The most important programs are those that use public campaigns to promote the detection and treatment of depression such as the European Alliance Against Depression (EAAD) [52]. Unfortunately, these programs have not been directed specifically to adolescents. More specific adolescent prevention programs have been well described by Gould et al. [53] and Shaffer and Pfeffer [54]. The past few years have seen some studies assessing various programs targeting suicidal youths. Although there are many prevention programs used in various settings (community resources, schools, emergency departments, etc.), the overall empirical evidence about effective ways to prevent or treat suicidality in youth is quite low [55]. Current efforts to establish more solid empirical evidence for suicide prevention include the Evidence Based Practices Project (EBPP), a national initiative to develop a registry of effective prevention programs in the United States [55]. Prevention efforts usually include interventions such as screening for depression and suicide risk in schools and clinical settings [56,57], suicide awareness and education programs [58,59], gatekeepers training for school staff [60•,61,62•], hotlines [63], means restriction [51] and as described earlier, pharmacological treatment and CBT/skills training. These strategies and specific programs need further systematic evaluation.

Conclusion

Adolescent suicide remains an important clinical problem and a major cause of death in young people. Nonfatal suicidal behavior is also associated with a great deal of morbidity and suffering. Major problems that remain to be solved are improving of definitions of different subtypes and phenotypes of suicidal behavior; following the dramatic time sequence, geographical and sex differences effecting suicidal behavior; pursuing the important investigation of biological and genetic factors, which interact with environmental factors, putting individuals at high risk of suicide; understanding some of the social and psychological variables that underlie suicidal behavior; and assessing existing suicide prevention programs for youth in different settings.

The identification of more specific risk factors of suicide will help better prediction of suicidality and hence, better assessment process, better treatment and more targeted prevention programs.

References and recommended reading

Papers of particular interest, published within the annual period of review, have been highlighted as:
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•• of outstanding interest

Additional references related to this topic can also be found in the Current World Literature section in this issue (p. 118).

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Original Article

History of suicide attempts in pediatric bipolar disorder: factors associated with increased risk

Goldstein TR, Birmaher B, Axelson D, Ryan ND, Strober MA, Gill MK, Valeri S, Chiappetta L, Leonard H, Hunt J, Bridge JA, Brent DA, Keller M. History of suicide attempts in pediatric bipolar disorder: factors associated with increased risk.
Bipolar Disord 2005: 7: 525–535. © Blackwell Munksgaard, 2005

Background: Despite evidence indicating high morbidity associated with pediatric bipolar disorder (BP), little is known about the prevalence and clinical correlates of suicidal behavior among this population.

Objective: To investigate the prevalence of suicidal behavior among children and adolescents with BP, and to compare subjects with a history of suicide attempt to those without on demographic, clinical, and familial risk factors.

Methods: Subjects were 405 children and adolescents aged 7–17 years, who fulfilled DSM-IV criteria for BPI (n = 236) or BPII (n = 29), or operationalized criteria for BP not otherwise specified (BP NOS; n = 140) via the Schedule for Affective Disorders and Schizophrenia for School-Aged Children. As part of a multi-site longitudinal study of pediatric BP (Course and Outcome of Bipolar Youth), demographic, clinical, and family history variables were measured at intake via clinical interview with the subject and a parent/guardian.

Results: Nearly one-third of BP patients had a lifetime history of suicide attempt. Attempters, compared with non-attempters, were older, and more likely to have a lifetime history of mixed episodes, psychotic features, and BPI. Attempters were more likely to have a lifetime history of comorbid substance use disorder, panic disorder, non-suicidal self-injurious behavior, family history of suicide attempt, history of hospitalization, and history of physical and/or sexual abuse. Multivariate analysis found that the following were the most robust set of predictors for suicide attempt: mixed episodes, psychosis, hospitalization, self-injurious behavior, panic disorder, and substance use disorder.

Conclusions: These findings indicate that children and adolescents with BP exhibit high rates of suicidal behavior, with more severe features of BP illness and comorbidity increasing the risk for suicide attempt. Multiple clinical factors emerged distinguishing suicide attempters from non-attempters. These clinical factors should be considered in both assessment and treatment of pediatric BP.

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Risk for completed suicide in bipolar disorder (BP) is among the highest of all psychiatric disorders (1); between 25% and 50% of adult patients with BP

make at least one suicide attempt in their lifetime, and between 8% and 19% of BP patients will die from suicide (2). Research indicates that between 20% and 65% of adults with BP experience onset in childhood (3, 4), and those adults with early illness onset are at higher risk for suicidal behavior (4, 5). Only in the last decade has there been increasing recognition, diagnosis, and treatment of BP in pediatric populations. Given the relative infancy of the field, it is not surprising that little is known about suicidal behavior in pediatric BP despite the apparent link between early illness onset and suicidality.

Evidence from case–control studies of adolescent suicide victims indicates that BP in adolescence imparts a particularly elevated risk for completed suicide (6, 7). Furthermore, reports from two longitudinal studies support significant mortality from suicide among pediatric BP patients. Srinath et al. (8) reported a 3% suicide rate among pediatric BPI patients 5 years after index episode hospitalization, whereas Welner et al. (9) documented a 25% suicide completion rate among a BP adolescent inpatient sample (when compared with 6% among unipolar patients) at 10-year follow up.

To date, few studies have examined suicidal behavior among BP children and adolescents. Strober et al. (10) reported medically significant suicide attempts in 20% of an adolescent BPI sample over 5-year follow up. Lewinsohn et al. (11) reported a 44% lifetime suicide attempt rate among adolescents with BP spectrum disorders – significantly elevated when compared with 22% of unipolar (UP) depressed teens and 1% of healthy controls. In this sample, BP attempters (when compared with UP attempters) were younger at first attempt, made more lethal attempts, and were more likely to make multiple attempts. Bhangoo et al. (12) reported a 47% attempt rate among BPI children and adolescents with an episodic pattern of mood symptomatology (one or more DSM-IV manic or hypomanic episodes), when compared with a 15% attempt rate for those patients with a chronic illness pattern (no discernable episodes).

Given preliminary studies documenting the elevated incidence of suicidal behavior among BP youth, Lewinsohn et al. (11) have called for comparative studies within the BP group to identify risk factors differentiating pediatric BP patients with a history of attempt from those without. This approach has been widely utilized in the adult literature, yielding a fairly consistent set of risk factors for suicidal behavior among BP adults. Findings indicate that BP adults with a history of suicide attempt are more likely to report a positive family history of suicide (13–15) and a history of physical and/or sexual abuse (16). Clinical characteristics of adult BP suicide attempters include the presence of dysphoric (i.e., mixed) manic states, multiple major depressive episodes (17), and a comorbid panic (18, 19) and/or substance use disorder (20). Trait aggression (21) and impulsivity (22) have also been linked to increased risk for suicide attempt among BP adults. The risk associated with psychosis is unclear, with some documenting increased suicidal behavior among BP patients with psychotic features (23) and others finding no difference (24). Similarly, the literature on suicide attempts and bipolar sub-categories is inconsistent, with some reporting higher attempt rates among BPII patients (25), others associating a BPI diagnosis with higher risk (26), and still others finding no differences between subtypes (27). Lastly, the protective effects of lithium treatment against suicide have been suggested among adult BP patients (28), whereas the literature on other classes of medications, including antidepressants, anticonvulsants, and atypical antipsychotics, remains inconclusive (29).

To date, research has not examined to what extent these risk factors for suicidal behavior among BP adults apply to youth with the illness. Given that investigators have elucidated several features distinguishing the illness in children and teens from that in adults (30, 31), distinct risk factors for suicidal behavior may also exist. Identification of such risk factors may serve to inform the development of both preventive and therapeutic interventions for this high-risk group. We therefore examined: (i) the lifetime prevalence and nature of suicidal behavior, and (ii) demographic, clinical, diagnostic, and family history variables associated with a lifetime history of suicide attempt, among a sample of pediatric BP patients enrolled in the Course and Outcome of Bipolar Youth (COBY) multi-site study. Subsequent studies will describe the incidence and risk factors associated with suicidal behavior over longitudinal follow up.

Methods

Participants

Subjects included 405 BP children and adolescents aged 7–17 who gave informed consent to participate in the evaluation of their illness in the COBY study, a longitudinal naturalistic multi-site study of pediatric BP. Subjects were primarily recruited through clinical referrals within three academic medical centers (University of Pittsburgh, n = 189; Brown, n = 138; and UCLA, n = 78); community

referrals and print advertisements were also utilized to recruit subjects. The Institutional Review Boards at each of the three participating universities reviewed and approved all study procedures prior to subject enrollment.

Inclusion criteria. Subjects met the following criteria: (i) current age 7 years 0 months to 17 years 11 months; (ii) fulfill criteria for DSM-IV bipolar I disorder (BPI), bipolar II disorder (BPII), or study-operationalized criteria for bipolar disorder not otherwise specified (BP NOS, see *Diagnosis* below) via the Schedule for Affective Disorders and Schizophrenia for School-Aged Children, Present Episode 4th version (K-SADS-P; 32) Depression Section and Mania Rating Scale (K-SADS-MRS; 33); (iii) determined to have a primary bipolar disorder (not induced by substance use, medications, or a medical condition); and (iv) intellectual functioning within normal limits.

Demographics/patient illness characteristics. The sample was comprised of 217 (54%) male subjects and 188 (46%) female subjects with an average age of 12.7 years (SD = 3.2). Subjects were, on average, middle class (mean socioeconomic status (SES) = 3.4, SD = 1.2; 34). Eighty-three percent (n = 338) of subjects identified themselves as Caucasian, 6% (n = 26) African-American, 8% (n = 33) bi/multi-racial, 1% (n = 5) Asian, and 1% (n = 3) other racial classification. Two hundred thirty-six participants (58%) met criteria for BPI, 29 (7%) BPII, and 140 (35%) BP NOS. Comorbid psychiatric conditions were common in this sample; on average, patients met DSM-IV criteria for three K-SADS diagnoses, the most common of which include attention deficit-hyperactivity disorder (ADHD; 60%) and oppositional defiant disorder (ODD; 39%).

Procedures

Diagnosis. All COBY diagnosticians have either a Bachelor's or Master's degree in a mental health field, and attended K-SADS training sessions. After consent and assent were obtained, parents were interviewed about their children and children were directly interviewed for the presence of non-mood psychiatric disorders using the K-SADS-PL (32). Due to the comprehensive coverage of symptoms, the K-SADS-P depression and mania sections were used to assess each period of mood problems in order to determine whether DSM-IV diagnostic criteria for a mood episode was met; onset and offset were determined for both current and most severe past episode DMS-IV mood

disorders. Severity of depressive and manic symptoms for the current affective episode (worst week in the month preceding assessment) was recorded on the K-SADS-P depression section and K-SADS-MRS. The most severe week of depressive and manic symptoms in the subject's lifetime was assessed via the K-SADS-PL in the first 87 subjects, and subsequently the K-SADS-P depression section and the K-SADS-MRS.

K-SADS symptom ratings and diagnoses were based on consensus ratings incorporating all available data; in the event of conflicting information, summary ratings were guided by clinical judgment. Diagnoses were confirmed by a child psychiatrist/psychologist subsequent to the interview. To maintain reliability across sites, bimonthly conference calls between sites addressed assessment questions and concerns. Based on ratings of 13 study interviews (4–7 raters per case), inter-rater reliabilities for mood disorders were ≥0.75 (kappa); kappas for non-mood disorders were ≥0.80. The intraclass coefficient (ICC) for the K-SADS-MRS (12 cases) was 0.96, and the Depression Rating Scale (DRS) (12 cases) was 0.98.

The National Institute of Mental Health (NIMH) Consensus Roundtable (34) recommends inclusion of children and adolescents with significant subsyndromal bipolar symptomatology in studies to further evaluate bipolar spectrum disorders in youth and maximize generalizability of results. Given that the DSM-IV criteria for BP NOS are vague and there are no other available criteria for this bipolar subtype, study investigators operationalized specific BP NOS criteria for the present study as follows: elevated and/or irritable mood, plus: (i) two associated DSM-IV manic symptoms (three if only irritable mood), (ii) change in functioning, (iii) mood and symptom duration of at least 4 h within a 24-h period, and (iv) episode frequency of at least four cumulative 24-h periods meeting the mood, symptom, and functional change criteria over the subject's lifetime. COBY data on clinical course and outcome provide preliminary validation for these operationalized BP NOS criteria (35).

Lifetime suicide attempt. Suicidal acts during the current affective episode (worst week in the month preceding evaluation), most severe past episode, and lifetime (summary diagnostic checklist suicidality item) were evaluated at intake via the K-SADS (see *Diagnosis*, above). According to the widely cited definitional system proposed by O'Carroll et al. (36), suicide attempt refers to 'a potentially self-injurious behavior with a non-fatal outcome for which there is evidence (either explicit

or implicit) that the person intended at some level to kill himself/herself. A suicide attempt may not result in injuries.' The term 'suicide gesture' is not recommended by the NIMH task force, nor is it included among operational definitions posed by experts in the field (36). In a review of assessment instruments for suicidal behavior in youth, Goldston (37) highlighted the use of the phrase 'gestures or attempts' in the K-SADS depression ratings suicidal acts item which serves to confound ratings of suicidal behavior and suicidal intent. It should be noted that this is not the case on the K-SADS Lifetime Diagnostic Checklist, where suicide gestures are assessed and rated separate from attempts. Although the term 'suicide gesture' is not operationally defined in the K-SADS, COBY evaluators were instructed to rate self-injurious behaviors 'judged to be non-serious in intent or medical lethality' (37) as 'gestures' on the Lifetime Diagnostic Checklist (any act with evidence of intent or lethality was rated as an attempt). As a means of addressing the confound in the K-SADS depression ratings, and capturing the core elements of the operationalized definition of suicide attempt, we defined a suicide attempt as a self-injurious act that includes some degree of seriousness and/or lethality. We then subjected all available information on suicidal acts gathered from the K-SADS to this definition to yield the specific criteria for suicide attempt utilized in the study (Table 1).

Other clinical information. Basic demographic information was obtained at intake, including a five-factor scale for socioeconomic status (38). Medication exposure history and history of abuse were systematically obtained using a medical history questionnaire widely utilized at the Western Psychiatric Institute in research protocols. Information on subjects' comorbid diagnoses and clinical characteristics (i.e., mixed episodes, psychosis, and self-injurious behavior) were garnered from summary scores from the K-SADS interview with the child and the parent. The age of onset for a subject's BP illness was considered to be when the subject first met DSM-IV criteria for a manic, mixed, hypomanic, or major depressive episode, or when he/she first met COBY criteria for BP NOS.

Parents of subjects were interviewed at intake about their personal psychiatric history using the Structured Clinical Interview for DSM-IV (SCID; 39). The parents were also interviewed regarding the psychiatric status of all first- and second-degree relatives using the Family History Screen, which has demonstrated adequate reliability and validity (40). A family history was considered to be positive if the disorder was rated as 'definitely' present in a relative.

Statistical analysis

Statistical analyses were performed using the Statistical Package for the Social Sciences Version 12 (SPSS). Analyses were conducted in three phases. First, potential risk factors were screened for their association with suicide attempt history using chi-square tests for categorical variables and t-tests for continuous variables. Given the dearth of information on predictors of suicide attempts in this population, we approached these analyses as hypothesis-generating, and therefore did not apply a statistical adjustment for multiple comparisons (e.g., Bonferroni). Second, factors that were associated with suicide attempts in the univariate analyses were entered into multivariate logistic regression models conducted in each of three identified domains: clinical/illness history, comorbid diagnostic conditions, and family history to estimate the adjusted odds of suicide attempt associated with each risk factor controlling for the effects of other risk factors within that domain. Statistical significance was set at $\alpha = 0.05$. Finally, in an attempt to examine the magnitude of these

Table 1. Suicide attempt criteria

Suicide attempt defined as fulfilling any one of the following three criteria		
Criteria 1	Criteria 2	Criteria 3
K-SADS-P depression section (0–6 scale)	K-SADS-PL depressive disorders section (0–3 scale)	K-SADS Summary Lifetime Diagnostic Checklist
At least one of the following:	At least one of the following:	Lifetime suicide attempt item rated 'yes' (clinically significant) by the evaluator
Seriousness	**Seriousness**	
Suicidal acts – seriousness rated '3' (definite but ambivalent) or above and/or	Suicidal acts – seriousness rated '2' (subthreshold) or above and/or	
Lethality	**Lethality**	
Suicidal acts – medical lethality rated '3' (mild) or above	Suicidal acts – medical lethality rated '2' (subthreshold) or above	

relationships and determine a model best fit to the data, a simultaneous logistic regression analysis was performed on the set of variables found significant in each of the three domain analyses.

Results

Prevalence and demographic variables

Thirty-two percent of the sample (n = 128) endorsed a lifetime history of at least one suicide attempt according to our criteria. As can be seen in Table 2, no significant differences emerged between attempters and non-attempters with respect to sex, race, socioeconomic status, or living situation. Suicide attempters in the sample were significantly older than non-attempters.

Figure 1 depicts K-SADS-P depression section most severe lifetime ratings of suicide items for suicide attempters in the sample. Sixty-seven percent of participants classified as suicide attempters had a lifetime history of frequent and intense suicidal ideation rated moderate or higher. According to the K-SADS seriousness of suicidal intent item, 11% of suicide attempts reported were classified as 'extreme-every anticipation of death.' Of note, 19% of those who were classified as suicide attempters according to our criteria denied suicidal ideation on the K-SADS interview. Medical lethality ratings indicate that the actual medical threat ascribed to attempts by evaluators was high, with 16% of attempts rated moderate or higher when accounting for considerations including method, likelihood of rescue, and amount of medical treatment required.

Clinical and illness history variables

The clinical characteristics of attempters and non-attempters are summarized in Table 3. Attempters were significantly more likely to have a lifetime history of psychiatric hospitalizations, mixed episodes, and psychotic features. Furthermore, attempters endorsed more lifetime non-suicidal self-injurious behavior as rated by the K-SADS,

referring to any physical self-damaging act performed *without intent of killing oneself* but with full intent of inflicting physical harm to oneself; examples include scratching, cutting, or burning oneself as a means of relieving or expressing emotional pain. Attempters also reported a greater history of physical and/or sexual abuse than non-attempters. More BP patients with illness onset after age 12 attempted suicide than those with illness onset prior to age 12. Moreover, a higher percentage of BPI participants attempted suicide than BP NOS ($\chi^2(1) = 7.48$, p < 0.01). We did not explore the relationship between pharmacological and/or psychosocial treatment history and attempter status.

Next, we conducted a logistic regression analysis in the clinical domain entering the significant variables from the univariate analyses (above) as predictors of suicide attempt status. After covarying for the effects of current age, four variables remained significantly predictive of increased risk for lifetime suicide attempt within the clinical domain: history of self-injurious behavior (OR = 2.45, 95% CI = 1.5–4.0, p < 0.01), psychiatric hospitalizations (OR = 2.48, 95% CI = 1.43–4.32, p < 0.01), mixed episodes (OR = 2.08, 95% CI = 1.15–3.74, p = 0.02), and psychosis (OR = 1.75, 95% CI = 1.04–2.92, p = 0.03).

We also examined the relationship between suicide attempter status and most severe lifetime ratings of functioning and symptomatology. Children's Global Assessment Scale ratings (C-GAS; 41) indicate that during the worst lifetime period of illness, suicide attempters were more impaired than non-attempters ($t = 5.91$, p < 0.01). Similarly, the most severe lifetime episode of depression rated on the K-SADS-DRS was significantly worse for attempters ($t = -6.73$, p < 0.01). However, worst manic episode ratings on the K-SADS-MRS did not distinguish between groups ($t = -1.32$, p = 0.2).

Comorbid diagnostic conditions

Table 4 summarizes the findings regarding Axis I comorbidity and suicide attempter status. All comorbid diagnoses considered are based on

Table 2. Demographic variables in pediatric bipolar suicide attempters and non-attempters

Variable	Attempters (n = 128)	Non-attempters (n = 277)	χ^2 or t	df	p-value
Age (Mean ± SD)	13.7 ± 3.1	12.3 ± 3.1	$t = -4.16$	403	<0.001
Sex (% female)	61 (48)	127 (46)	$\chi^2 = 0.12$	1	0.73
Race (% Caucasian)	108 (85)	230 (83)	$\chi^2 = 0.11$	1	0.74
Socioeconomic status[a] (Mean ± SD)	3.5 ± 1.1	3.4 ± 1.2	$t = -0.46$	403	0.65
Living situation (% with both parents)	51 (40)	123 (45)	$\chi^2 = 1.26$	1	0.53

[a]Hollingshead (38).

|		Suicidal ideation Includes preoccupation with thoughts of death/suicide and auditory hallucinations	Suicide attempts: seriousness Seriousness of suicidal intent as expressed in suicidal act, i.e. likelihood of rescue, precautions against discovery, actions to gain help afterward, degree of planning, apparent purpose of attempt	Suicide attempts: lethality Actual medical threat to life or physical condition following the suicidal act
None	▦	Not present	Obviously no intent, purely manipulative gesture	No danger, e.g., no effects, held pills in hand
Slight	▦	Thoughts of his death, 'I wish I were dead' or only in anger	Not sure or only minimal intent	Minimal, e.g., scratch on wrist
Mild	▦	Occasional thoughts of suicide but has not thought of a specific method	Definite but very ambivalent	e.g., took 10 aspirin, mild gastritis
Moderate	▨	Often thinks of suicide and has thought of a specific method	Serious	e.g., took 10 Seconals, brief unconsciousness
Severe	▦	Often thinks of suicide, thought of or mentally rehearsed a plan, made a suicidal gesture, or heard voice telling him to kill self	Very serious	e.g., cut throat, hanging
Extreme	▦	Made preparations for a potentially serious suicide attempt	Every anticipation of death	e.g., respiratory arrest, coma
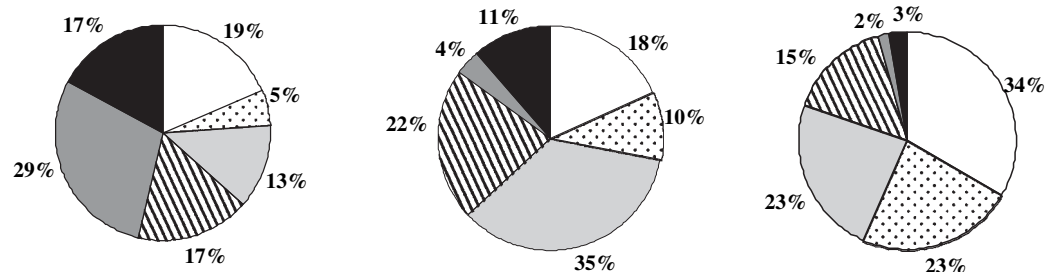
Fig. 1. K-SADS-P Depression Section lifetime severity ratings for suicide attempters.

Table 3. Clinical/illness history variables and history of suicide attempt

	Attempters n = 128 (%)	Non-attempters n = 277 (%)	χ^2	df	p-value
Psychiatric hospitalization	96 (75)	123 (45)	32.63	1	<0.001
Self-injurious behavior	69 (54)	83 (30)	21.69	1	<0.001
Mixed episodes	49 (38)	52 (19)	17.80	1	<0.001
Psychosis	56 (44)	74 (27)	11.66	1	0.001
Physical/sexual abuse	41 (32)	54 (20)	4.56	1	0.006
Age of BP onset (>age 12)	45 (35)	69 (25)	4.55	1	0.03
Bipolar subtype			12.58	2	0.002
Bipolar I	86 (67)	150 (54)			
Bipolar II	13 (10)	16 (6)			
Bipolar NOS	29 (23)	111 (40)			

BP = bipolar disorder; NOS = not otherwise specified.

fulfilling lifetime criteria. Analyses indicate that a comorbid substance use disorder and panic disorder were more common among attempters than non-attempters. Attempters were significantly less likely to meet criteria for a lifetime diagnosis of ADHD. However, neither the presence of a comorbid anxiety disorder, nor a disruptive behavioral disorder (ODD or conduct disorder), was significantly related to suicide attempter status.

The logistic regression analysis (with age entered as a covariate) in the diagnostic comorbidity domain indicates that lifetime panic disorder (OR = 4.28, 95% CI = 1.64–11.18, p < 0.01) and substance use disorder (OR = 2.86, 95%

Table 4. Comorbid diagnostic conditions and history of suicide attempt

	Attempters n = 128 (%)	Non-attempters n = 277 (%)	χ^2	p-value
Panic disorder	15 (12)	7 (3)	14.40	<0.001
Substance use disorder	22 (17)	14 (5)	15.91	<0.001
ADHD	62 (48)	179 (65)	9.52	0.002
Any anxiety disorder	57 (45)	104 (38)	1.78	0.2
Conduct disorder	20 (16)	32 (12)	1.30	0.3
ODD	45 (35)	111 (40)	0.89	0.4

df = 1 for all. ADHD = Attention Deficit-Hyperactivity Disorder; ODD = Oppositional Defiant Disorder.

CI = 1.34–6.14, p < 0.01) remain significantly associated with suicide attempt. There was a trend for an ADHD diagnosis to incur decreased risk for suicidal behavior (OR = 0.65, 95%CI = 0.41–1.03, p = 0.07).

Family variables

Examination of family history variables (Table 5) indicates that suicide attempters were more likely to have a positive family history of suicide attempt. A trend emerged, nearing statistical significance, for greater likelihood of suicidal behavior in relatives of attempters. However, family history positive for major depression, mania, conduct disorder, substance use disorder, and suicide completion was not significantly different between attempters and non-attempters. Controlling for the effects of current age, logistic regression in the family domain shows that neither family history of suicidal attempts (OR = 1.59, 95% CI = 0.88–2.85, p = 0.1) nor suicidal behavior (OR = 1.25, 95% CI = 0.70–2.20, p = 0.5) remain significantly related to attempter status.

Best-fit model

In order to examine a model best fit to predict suicide attempter status, we entered the six sur-

Table 5. Family history variables and history of suicide attempt

	Attempters n = 128 (%)	Non-attempters n = 277 (%)	χ^2	p-value
Major depression	111 (89)	219 (83)	2.04	0.2
Mania	62 (50)	134 (51)	0.10	0.7
Conduct disorder	44 (36)	81 (31)	0.72	0.4
Substance use disorder	87 (70)	188 (72)	0.20	0.7
Suicidal behavior	64 (52)	108 (42)	3.11	0.08
Suicide attempt	59 (48)	96 (37)	4.0	0.05
Suicide completion	7 (6)	12 (5)	0.21	0.7

df = 1 for all.

Table 6. Best-fit model of predictors of suicide attempts

	OR	95% CI	Wald	p-value
Psychiatric hospitalization	2.47	1.48–4.13	11.84	0.001
Self-injurious behavior	2.24	1.39–3.63	10.81	0.001
Mixed episodes	2.03	1.21–3.41	7.17	0.007
Panic disorder	4.0	1.36–11.76	6.34	0.01
Substance use disorder	2.76	1.21–6.28	5.86	0.02
Psychosis	1.73	1.05–2.85	4.67	0.03

Current age entered as covariate.

viving predictors from the domain-specific regression analyses [lifetime psychosis, mixed states, psychiatric hospitalizations, and self-injurious behavior (domain: clinical/illness history variables); lifetime panic disorder and substance use disorder (domain: comorbid diagnostic conditions); no variables from the family history domain remained significantly associated with suicide attempter status] into one logistic regression analysis. All predictors remained significantly associated with suicide attempt status in the model (Table 6); a goodness-of-fit test (HL $\chi^2 = 6.61$, p = 0.60) indicates that this model represents a good fit for the data.

Discussion

In our sample of pediatric BP subjects, 32% had made at least one lifetime suicide attempt characterized by significant seriousness and/or lethality. This prevalence rate is in the mid-range of the three existing studies documenting suicide attempt rates in BP children and adolescents: 20% over 5-year follow up in BPI adolescents (10), 44% in a community sample of adolescents with BP spectrum disorders (11), and 15% for chronic BPI, 47% for episodic BPI pediatric patients (12). Differences in reported prevalence rates between these samples may be attributable to age ranges included in the sample (childhood versus adolescence), severity of the sample (BPI versus other BP types), time frame of suicide attempts assessed (lifetime versus follow up), and methods of assessing/defining suicide attempt employed in each of the studies. To date, there have been no completed suicides in our sample.

To our knowledge, this is the first report on the correlates of suicidal behavior in pediatric BP. Results of the present study indicate that several of the risk factors associated with suicidal behavior in adult BP are also related to suicidal behavior in pediatric BP. Our findings suggest that the most robust predictors of suicide attempt fall into two domains: clinical/illness history variables and comorbid diagnostic conditions. Family history variables emerged as less salient in predicting suicide attempter status.

In keeping with findings from the adult BP literature (17, 23), children and adolescents in the COBY sample with a history of mixed episodes and psychotic features were more likely to have attempted suicide. The available data does not allow us to examine the temporal relationship between these clinical features and suicide attempts; however, future analyses of the COBY longitudinal follow-up data will allow for examination of clinical state preceding suicidal behavior.

Both comorbid substance use disorder and panic disorder have been shown to impart elevated risk for suicide attempt in adult BP, and these comorbidities also appear to be risk factors for suicide attempts in pediatric BP. Given findings documenting elevated levels of impulsivity among adult BP suicide attempters (22), and the impulsivity often associated with ADHD, we were surprised to find that a higher percentage of non-attempters had a lifetime history of ADHD in the sample. However, other studies have failed to find any relationship between ADHD and suicidal behavior in adolescents (42).

Those patients with a history of suicide attempt exhibited a more severe illness history, with a greater history of psychiatric hospitalizations, and more severe lifetime ratings of global functioning and depression. However, ratings of most serious lifetime manic episode did not distinguish attempters from non-attempters. These findings highlight the importance of assessing both current symptomatology and past episodes when assessing suicidal risk in pediatric BP patients.

A history of non-suicidal self-injurious behavior emerged as a robust predictor of suicide attempts in this population, replicating findings among adult psychiatric populations (43, 44). The nature of this relationship remains largely unexplored to date. Nock and Prinstein (45) posited that self-injurious behavior and suicide attempts share a functional drive: escaping negative experiences. Moreover, self-injurious behavior and suicide attempts share common etiological factors, including negative mood, impulsivity, and a history of trauma (46, 47). It is also possible that in pediatric BP, self-injurious behavior may represent a marker for more severe affective dysregulation and/or illness severity as has been proposed in the literature on borderline personality disorder (48). In fact, the common clinical features of affective lability and suicidality in bipolar and borderline disorders have led some to argue that these diagnoses lie along a continuum of mood disorder (49). Future studies should therefore consider assessing Axis II pathology in order to further explore this relationship in youth.

Further exploration of the role of genetics in suicidal behavior may also be warranted given the finding that pediatric BP suicide attempters have higher rates of suicide attempts among family members. Findings from Brent et al. (50) support a genetic link to suicidal behavior over and above the risk for affective disorder. It is also possible that an environmental learning component may contribute to the modeling of suicidal behavior in these families.

In keeping with findings from the general literature on adolescent suicide (51), younger patients in the COBY sample were less likely to have attempted suicide than older adolescents, likely due to a complex interaction of developmental, psychological, and family factors. Although age of BP onset did not survive the logistic regression analysis, univariate analysis indicates that a higher percentage of attempters reported illness onset after age 12. This finding may initially appear contrary to the adult BP literature in which earlier age of onset has been associated with higher risk (5). However, in their study establishing the relationship between earlier age of BP onset and attempts in adults, Leverich et al. reported a mean onset age of 17 for attempters (versus 21 for non-attempters), highlighting the fact that 'early onset' is a relative term. Given that the COBY sample focuses expressly on a pediatric sample and therefore includes 17 as the upper age limit, it is possible that a critical period for vulnerability to the development of suicidal behavior exists for pediatric onset, when compared with adult-onset, BP.

The significant association in the univariate analysis between a history of physical/sexual abuse and lifetime suicide attempt is in accordance with the findings of Leverich et al. (5, 16) linking sexual abuse and suicide attempts in BP adults. This relationship suggests that early adverse experiences may serve to create a vulnerability for subsequent affective episodes.

Our findings suggest that a BPI diagnosis imparts elevated risk for suicide attempts over BP NOS in children and adolescents. One possible interpretation is that BPI represents a more severe form of the illness than BP NOS. No significant differences emerged with respect to the BPII subtype. In multiple studies from the adult literature, a diagnosis of BPII has been associated with increased risk for suicidal behavior. This disparity in findings may be related to the small number of BPII patients in our sample (7%), resulting in insufficient power to detect group differences. Alternatively, findings indicate BPII may be an unstable diagnostic category in pediatric patients, as 20% of BPII children and teens go on to develop BPI (35). Future studies may aim to examine a

larger sample of BPII patients to further explore differences between bipolar subtypes.

Limitations

The limitations of the present study include the reliance on patient and parent retrospective report of suicidal behavior. Additionally, the K-SADS depression ratings do not distinguish between suicide gestures and suicide attempts despite expert recommendations calling for standardized nomenclature for suicidal behavior in which the term 'gesture' is not endorsed (36). To decrease the likelihood that self-injurious behaviors (i.e., gestures) would be counted as suicide attempts, and that suicidal acts and intent would be confounded by K-SADS depression ratings, we further limited the definition of suicide attempt used herein to include only those acts of self-harm that included some degree of intent and/or lethality. Furthermore, given that K-SADS ratings of suicidal behavior are gathered only in the context of the current and most severe past depressive episodes, suicidal acts occurring outside of these discrete mood episodes may have gone unreported. We aimed to capture those lifetime suicide attempts occurring outside of the K-SADS mood episode ratings (and thereby decrease the likelihood that our findings *underestimate* suicide attempts in this population) by including an affirmative evaluator rating on the suicide attempt item on the K-SADS Summary Lifetime Diagnostic Checklist in our definition of suicide attempt. Furthermore, detailed information regarding method and precipitants of suicide attempts are not gathered via the K-SADS ratings.

COBY is primarily a clinical sample recruited from outpatient and inpatient facilities, and thus may not be representative of pediatric BP patients who have not sought treatment. Furthermore, the COBY sample is predominately Caucasian. Given that risk factors for suicidal behavior specific to certain minority groups have been identified (51), the present findings may not be representative of cultural minority groups.

The present study does not allow us to infer the direction of the relationship between the identified risk factors and suicide attempts in this population. Furthermore, we were not able to explore the temporal relationship between risk factors (e.g., onset of substance use, physical and/or sexual abuse) and suicide attempts, such that certain risk factors may have come after the suicide attempt rather than as precursors. We also did not examine clinical presentation at the time of attempt, nor the relationship between psychosocial and pharmaco-logical treatments and suicidal behavior. Future studies from the COBY sample using longitudinal data will aim to address the temporal relationship between these variables.

Clinical implications

Pediatric BP carries a high risk for suicidal behavior. Early recognition of those pediatric BP patients at highest risk for suicidal behavior may guide our clinical recognition of, and intervention for, those at highest risk. Findings from the present study indicate that pediatric bipolar patients at highest risk for suicide attempt include those who are older, with a lifetime history of mixed episodes, psychotic features, and BPI, comorbid substance use, panic disorder, non-suicidal self-injurious behavior, family history of suicide attempt, history of hospitalization, and history of physical and/or sexual abuse. Although at present we know little about the treatment of suicidality in pediatric BP patients, the present findings highlight the importance of future work on the development, study, and improvement of treatments for suicidal behavior in pediatric BP.

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Interventions for Suicidal Youth: A Review of the Literature and Developmental Considerations

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Suicidal behavior is developmentally mediated, but the degree to which interventions for suicidal behaviors have been developmentally tailored has varied widely. Published controlled studies of psychosocial treatment interventions for reducing adolescent suicidal behavior are reviewed, with a particular emphasis on the developmental nuances of these interventions. In addition, developmental considerations important in the treatment of suicidal adolescents are discussed. There are insufficient data available from controlled trials to recommend one intervention over another for the treatment of suicidal youth, but interventions that are sensitive to the multiple developmental contexts have potential for greater effectiveness in reducing adolescent suicidal behavior.

Suicidal behavior is clearly developmentally mediated. For example, according to the Centers for Disease Control and Prevention (CDC) data for 1999 to 2005, there were no suicides among children ages 4 and younger (Centers for Disease Control and Prevention, 2008a). The rate of suicide for children ages 5 to 9 was quite low, 0.02 deaths per 100,000. In contrast, the rate of death by suicide for 10- to 14-year-olds, 15- to 19-year-olds, and 20- to 24-year-olds was 1.28, 7.79,

and 12.27 per 100,000, respectively (Centers for Disease Control and Prevention, 2008a). The rates were higher through adulthood (e.g., 13.76 and 14.61 per 100,000 for 25- to 44-, and 45- to 64-year-olds, respectively) and were particularly high for men over the age of 65 (28.64 and 4.03 per 100,000 for 65- to 84-year-old men and women, and 50.32 and 3.76 per 100,000 for 85+ year-old men and women, respectively; CDC, 2008a). Likewise, rates of suicide attempts change as a function of age. In studies of both clinical and community-based samples, youth show increased rates of suicide attempts from early- to mid-adolescence (Angle, O'Brien, & McIntire, 1983; Kovacs, Goldston, & Gatsonis, 1993; Lewinsohn, Rohde, Seeley, & Baldwin, 2001). Results of at least one epidemiologic study have suggested that rates of suicide attempts may then decline after adolescence, especially among females (Lewinsohn et al., 2001). Among older adults, the rates of nonlethal suicide attempts to death by suicide are much lower than they are for younger populations (Conwell & Thompson, 2008; Friedmann & Kohn, 2008).

Suicidal behaviors may have different characteristics and pose different burdens as individuals develop across the lifespan. Nonetheless, nonlethal suicidal behavior in adolescence is a particular public health problem because of the high rates of suicide attempts during this developmental period (Centers for Disease Control and Prevention, 2008b), and because nonlethal suicidal behavior is one of the primary reasons for child psychiatric emergency room visits and hospitalizations (Goldstein, Frosch, Davarya, & Leaf, 2008; Peterson, Zhang, Saint Lucia, King, & Lewis, 1996) and one of the best predictors of future attempts and deaths by suicide (e.g., Joiner et al., 2005). In addition, despite the fact that deaths by suicide are relatively low during this period compared to the rates for older men in particular, suicide is nonetheless the third leading cause of death in this age group (Centers for Disease Control and Prevention, 2008a). While an extensive discussion of the developmental nuances and considerations for interventions for suicidal behavior across the lifespan is beyond the scope of the current review and paper, it could be argued that interventions for mental health problems at different points in the lifespan should be developmentally tailored, and yet they often are not. For example, interventions for suicidal behaviors and risk among elders need to consider the fact that older individuals, especially older males, do not as readily disclose mental health difficulties or seek mental health services relative to individuals at other ages (Conwell & Thompson, 2008). It particularly is the case that interventions for the mental health problems of youths, including suicidality, are not developmentally tailored (Weisz & Hawley, 2002). Rather, it is often the case that adolescents are treated with variations of interventions originally developed for adults (Weisz & Hawley, 2002).

Developmentally, adolescents differ from younger youth and from adults in ways that may increase their risk for suicidal behaviors. For example, adolescents may be more impulsive and may have a different time perspective than adults, and may focus more on proximal consequences of behavior than more distant goals when making decisions (Nurmi, 1991; Reyna & Farley, 2006). Suicidal behavior of adolescents also occurs in different contexts than the suicidal behavior of older individuals. For example, adolescent suicidal behavior often occurs in the context of family conflict, including strivings for autonomy, in the context of academic and disciplinary difficulties, or as a consequence of disruptions in peer relationships that are increasing in importance as youth get older.

In sum, suicidal behavior is increasingly prevalent during adolescence and needs to be considered in a developmental context. Likewise, intervention efforts for adolescent suicidal behavior need to be appropriate to the developmental level, and to the peer, family, and school contexts within which suicidal behavior of adolescents occurs. The purposes of this paper are therefore twofold. First, we review the literature regarding controlled studies of psychosocial treatment interventions for reducing or preventing the recurrence of adolescent suicidal behavior. Although there have been other reviews of some of the studies described (e.g., Macgowan, 2004), this particular review is focused primarily on the developmental nuances of these interventions. Second, for future intervention development and refinement, we discuss developmental considerations important in the treatment of suicidal adolescents.

METHODS

Treatment studies in which youth suicidal thoughts, suicide attempts, combined suicidal and nonsuicidal self-harm behaviors, or participation in treatment for suicidal behaviors were identified via a search of the PSYCHINFO and MEDLINE data bases for articles published through July, 2008. For inclusion in the review, studies did not need to provide documentation of physical injuries associated with self-injury. This decision was made because recommended operational definitions of suicide attempts emphasize intent but do not require the presence of injury

(O'Carroll et al., 1996), and because medical lethality and stated intent of suicidal behaviors have not always been consistently related across studies among youths (Goldston, 2003). To keep the focus of this review on youths, we chose not to include studies with combined samples of adults and older adolescents, or studies of college students, whom we considered to be young adults. Only studies for which comparison group data were available were included. In the Results section, we first review the developmental nuances of these interventions including study modifications or design characteristics that were based on assumptions about the "developmental level" of youths, or which considered the environmental context—family, peer, school—of youth suicidal behavior. We then review evidence regarding the efficacy of these interventions.

RESULTS

*Overview of Intervention Research
for Suicidal Youth*

Studies evaluating the impact of interventions for suicidal youth can broadly be divided into two groups—those in which suicidal youth (and families) are randomly assigned to the intervention under study or a comparison group, and those in which the assignment to experimental or comparison condition is not random (quasi-experimental studies). The descriptions of participants and design of studies are noted in Table 1.

Quasi-experimental Studies. Five quasi-experimental studies examining the utility of interventions for suicidal youth were located. Nonrandom assignment to experimental and comparison conditions in these studies was based on convenience factors such as time of presentation and bed availability in three studies (Greenfield, Larson, Hechtman, Rousseau, & Platt, 2002; Katz, Cox, Gunasekara, & Miller, 2004; Rotheram-Borus et al., 1996; Rotheram-Borus, Piacentini, Cantwell, Belin, & Song, 2000), on site location in one study (Deykin, Hsieh, Joshi, & McNamara,

1986), and on symptom presentation in another study (Rathus & Miller, 2002).

Three of the studies (Deykin et al., 1986; Greenfield et al., 2002; Rotheram-Borus et al., 1996, 2000) focused on interventions that were developed to foster help-seeking and/or to improve follow-up with aftercare and rapidity with which aftercare services are provided. These efforts were predicated in part by the observation that suicidal youth tend to keep fewer outpatient aftercare appointments than nonsuicidal youth, and tend to drop out of treatment earlier than other youth receiving psychiatric treatment (Trautman, Stewart, & Morishima, 1993). It is not clear whether adolescents actually drop out of treatment at higher rates than adults, but it has been assumed by some that many adolescents do not have the tolerance for prolonged therapy (Rathus & Miller, 2002) or the continued capacity to focus on "verbalization or examination of feelings" (p. 90) in therapy (Deykin et al., 1986).

In the first of these studies (Rotheram-Borus et al., 1996, 2000), female suicide attempters presenting in the emergency department were assigned to a motivational-educational emergency room (ED) intervention or to standard emergency room care. The brief ED intervention consisted of education to staff and a videotaped presentation for families describing the dangers of suicidal behavior and benefits of treatment, and a family therapy session. The ED intervention was designed to engage the family and to initiate steps to mend the parent-child relationship. In the second study (Greenfield et al., 2002), youth in the ED were assigned to a rapid-response outpatient team to facilitate post-ED care, or were treated as they normally would (e.g., hospitalized, seen by the psychiatrist on call in outpatient treatment, or referred to providers in the community). The rapid response team contacted families immediately after ED visits to arrange aftercare service provision. The third study evaluated the relative effectiveness of a two-part intervention for youth presenting in the ED compared to treatment as usual (Deykin et al., 1986). In this program, community out-

TABLE 1
Interventions for Suicidal Youth

Study	Participants	Study Design
Deykin et al. (1986)	From emergency room settings, $n = 172$ predominantly black, Protestant 13–17 year olds with suicidal or life-threatening behaviors were seen at the hospital with the experimental supportive/educational intervention, and 147 predominantly white, Catholic adolescents were seen at the comparison hospital.	Quasiexperimental: Youth at one hospital were assigned to an intervention designed to offer support to and advocacy to the adolescent, and education to individuals in the schools and service system. Youth at a comparison hospital received treatment as usual.
Greenfield et al. (2002)	From emergency room setting, $n = 158$ 12–17-year-old youth were assigned to the rapid response intervention and $n = 128$ were assigned to treatment as usual.	Quasiexperimental: Assignment to rapid response outpatient services versus treatment as usual (with a wait of up to 10 days for services) depended upon the on-call psychiatrists at the time of the emergency room evaluation.
Katz et al. (2004)	In a hospital setting, $n = 62$ 14–17-year-old adolescents participated in the study. One-year follow-up data were available for $n = 26$ adolescents assigned to a DBT inpatient unit and $n = 27$ from the comparison inpatient unit.	Quasiexperimental: Assignment to DBT inpatient unit and DBT individual/group therapy versus a psychodynamic inpatient unit depended upon bed availability
Rathus & Miller (2002)	$n = 29$ adolescents assigned to DBT and $n = 82$ adolescents assigned to TAU. Youth assigned to DBT were older, more likely to be female, and more symptomatic than those assigned to TAU.	Quasiexperimental: Youth who were suicidal and met at last three of the criteria for borderline personality were assigned to DBT. Other youth were assigned to TAU (supportive and/or psychodynamic individual therapy, and family therapy based on family systems model).
Rotheram-Borus et al. (1996, 2000)	$n = 65$ 12–18-year-old females (primarily Latinas) were assigned to specialized ED treatment, and $n = 75$ adolescent females were referred to standard ED care.	Quasiexperimental: Assignment to specialized ED intervention (videotaped presentation to families, one crisis family therapy session, education to ED staff) versus treatment as usual depended upon the time of ED visit. All youth received brief cognitive-behavioral therapy following the ED visit/intervention.
Cotgrove et al. (1995)	$n = 47$ 12–16 year olds discharged from hospital following a suicide attempt were assigned to the intervention group, and $n = 58$ youth were assigned to routine care.	Randomized Trial: Adolescents were assigned to the experimental intervention of a "green card" allowing re-admission to hospital in addition to routine care or to routine care only.

(continued)

TABLE 1
Continued

Study	Participants	Study Design
Donaldson et al. (2005)	$n = 15$ 12–17 year olds with recent suicide attempts and seeking treatment either through the general pediatric emergency department or child psychiatric inpatient unit were assigned to the skills-based intervention, and $n = 16$ adolescents to the nondirective supportive therapy.	Randomized Trial: Adolescents were assigned to a skills-based (cognitive-behavioral) intervention or to nondirective, supportive therapy.
Harrington et al. (1998)	$n = 85$ adolescents ages 16 or younger with a suicide attempt by overdose were assigned to the family intervention and $n = 77$ were assigned to routine care.	Randomized Trial: Adolescents were assigned to a brief home-based problem-focused family intervention in addition to routine care or to routine care alone.
Huey et al. (2004)	$n = 156$ 10–17 year old predominately male and African-American youths, with Medicaid or no insurance, referred for emergency psychiatric hospitalization due to suicidal ideation, suicide attempts, homicidal ideation or behavior, other threats of harm to self or others, and psychosis.	Randomized Trial: Adolescents were assigned to multisystemic therapy (MST) or to hospitalization and routine aftercare.
King et al. (2006)	$n = 151$ adolescents who were hospitalized psychiatrically for suicidal behaviors were assigned to the Youth support Team (YST) intervention and 138 were assigned to treatment as usual (TAU).	Randomized Trial: Adolescents were assigned to the YST intervention in addition to TAU or to TAU alone.
Spirito et al. (2002)	$n = 29$ primarily female 12–18-year-old youth seen in an ED or pediatric inpatient service following a suicide attempt participated in this study in the experimental compliance enhancement intervention, and $n = 34$ in the standard disposition planning group.	Randomized trial: Adolescents were assigned to a compliance enhancement intervention using a problem-solving approach or to standard disposition planning.
Wood et al. (2001)	$n = 32$ 12–16-year-old youth with repeated suicidal or nonsuicidal repeated self-harm behavior were assigned to group therapy and $n = 31$ adolescents were assigned to routine care.	Randomized Trial: Adolescents were assigned to developmental group therapy (cognitive-behavioral therapy, dialectical behavior therapy, psychodynamic group therapy) in addition to routine care or to routine care alone.

reach social workers directly provided services such as general emotional support, facilitation of follow-through with aftercare, and advocacy for suicidal adolescents with family, schools, or the legal system. Direct services did not focus on discussion of feelings because of adolescents' presumed difficulties in participating in such activities. In

recognition of the context within which adolescent suicidal behavior occurs, both adult providers of the services (e.g., teachers, court personnel) and peer leaders in schools were provided education about depression and suicidality.

The ED intervention by Rotheram-Borus et al. (1996, 2000) was associated with an increase in therapy appointments attended by adolescents, and a decrease in suicidal ideation relative to routine care at the end of treatment, but no significant differences in suicidal ideation or attempts at an 18-month follow-up. The supportive and educational intervention described by Deykin and colleagues (1986) similarly did not result in differences in presentations in the ED for suicidal ideation, suicide attempts, life-threatening behavior, or self-harm without suicidal intent, but did result in increases in compliance with medical recommendations. The rapid response intervention of Greenfield et al. (2002) resulted in shorter time to aftercare and lower rates of hospitalization, but no differences on a scale assessing a spectrum of suicidal behavior from suicide ideation to serious suicide attempts.

The last two of the quasi-experimental studies focused on adaptations of dialectical behavior therapy (DBT; Katz et al., 2004; Rathus & Miller, 2002). DBT is a variation of individual and group cognitive-behavioral therapy that has been shown to be effective in reducing self-harm behaviors for adults with borderline personality disorder (Linehan, 1993; Linehan et al., 2006). In both of the studies with youth, adaptations were made to DBT to increase its relevance for adolescents. In the Rathus and Miller (2002) study, parents were involved in the skills training group so they could serve as coaches, family members were involved in the individual therapy sessions when family issues were perceived as paramount, efforts were made to target dysfunctional or invalidating family environments, and the length of therapy was reduced and skills-training simplified relative to what is provided to adults. Secondary treatment targets also focused on developmental themes such as the balance between adolescent strivings for self-determination versus parental need for monitoring and discipline, and issues regarding individuation versus dependence on the family (Rathus & Miller, 2000). Similar changes were made in the Katz et al. (2004) study. However, because these youth were psychiatrically hospitalized, a DBT inpatient milieu was also developed to foster further generalization of skills.

The outpatient DBT of Rathus and Miller (2002) resulted in lower rates of hospitalization and higher rates of treatment completion, but no group differences in clinician-recorded suicide attempts. The inpatient DBT intervention resulted in fewer behavioral incidents on the inpatient unit, but no significant differences in severity of depression, severity of suicidal thoughts, or number of parasuicidal (suicidal and nonsuicidal self harm behavior; Katz et al., 2004).

Randomized Controlled Trial Studies. Seven randomized controlled trials evaluated interventions for suicidal adolescents. Two of the studies (Harrington et al., 1998; Huey et al., 2004) examined in-home family interventions. Other studies included a social support intervention (King et al., 2006), cognitive-behavioral treatment (Donaldson, Spirito, & Esposito-Smythers, 2005), and group therapy for suicidal adolescents (Wood, Trainor, Rothwell, Moore, & Harrington, 2001). Two studies focused on service utilization for suicidal youth (Cotgrove, Zirinsky, Black, & Weston, 1995; Spirito, Boergers, Donaldson, Bishop, & Lewander, 2002).

In the first randomized controlled study (Harrington et al., 1998), the effectiveness of an in-home family intervention in addition to routine care for children and adolescents who had attempted suicide via overdose was evaluated. The intervention (one assessment and four treatment sessions) was brief in recognition of the risk of early treatment drop-out or discontinuation of treatment by suicidal adolescents (Trautman et al., 1993), and home-based, because of the frequently observed relationship between adolescent suicidal behaviors and family difficulties. Sessions included a focus on family problem-solving and communication and

"the developmental issues of adolescence and their impact on the family" (p. 513). In the second family study, Huey and colleagues (2004) evaluated the efficacy of a multisystemic family therapy intervention (MST) compared to psychiatric hospitalization in reducing suicide attempts among youth referred for emergency psychiatric hospitalization. MST is a home-based intervention developed for families of youth with behavioral and emotional difficulties that emphasizes intervention at the point of performance (e.g., in the school, home, or community). The intervention utilizes evidence-based (often behavioral) interventions to improve parenting ability and communication with youths, to promote prosocial activity among youths, and to address systemic factors that may be contributing to difficulties.

The in-home family intervention of Harrington et al. (1998) did not result in overall treatment group differences in severity of suicidal ideation. However, subgroup analyses did reveal that there were significant reductions in suicidal thoughts among youth who were not depressed. MST resulted in a greater decrease in the occurrence of youth-reported suicide attempts over the one-year follow-up than hospitalization (Huey et al., 2004). However, the youth assigned to MST also had higher rates of attempts at study entry, and the rates of attempts at one year were comparable for youth with and without MST. There were no differences in parent-reports of self-harm behavior or suicidal ideation.

Donaldson and colleagues (2005) compared a skills-based (cognitive-behavioral) intervention to supportive therapy for suicidal adolescents. The skills-based intervention emphasized problem solving and affect management skills and routinely included parents in providing collateral information at each treatment session. Two optional family sessions were allowed in the treatment protocol in situations where the family difficulties appeared to be interfering with treatment progress. The treatment was kept brief because of rates of treatment drop-out by suicidal youths. The intervention did not result in differences in severity of suicide ideation or in rates of suicide attempts over the follow-up.

King and colleagues (2006) examined the effectiveness of assistance provided by a Youth-Nominated Support Team (YST) in addition to routine care for formerly hospitalized adolescents. Weekly contact between the youth and the YST members nominated by the youth was encouraged, and psychoeducation and training was provided to the support team. In 62% of cases, a parent was nominated as one of the support persons. However, the YST approach also recognized that outside-the-family supports (e.g., individuals in the schools, extended family, or religious community) can be useful for suicidal adolescents because some parents of suicidal teenagers have significant difficulties of their own that interfere with their ability to be supportive of youths, and because teenagers begin to reach beyond their immediate family for support as they grow older. The YST intervention did not result in significantly reduced suicide attempts, but girls in the YST group showed greater reductions in severity of suicidal ideation and functional impairment relative to those assigned to TAU.

Wood and colleagues (2001) examined the combination of "developmental group psychotherapy" and routine care for adolescents who had engaged in suicidal and non-suicidal self harm behavior at least twice in the year prior to treatment referral. The intervention was designed to be sensitive to the developmental needs of adolescents and included approaches from cognitive-behavioral therapy, dialectical behavior therapy, and psychodynamic group psychotherapy. The intervention consisted of an initial assessment, six *acute* group sessions, and a *long-term group* therapy continuing until the youth considered themselves ready to leave. The acute group sessions were focused on six main themes considered to be relevant to self-harming adolescents including "relationships, school problems and peer relationships, family problems, anger management, depression and self-harm, and hopelessness and feelings about the future" (p. 1247). The long term group primarily focused on group processes. Although no differences were found between groups in severity of depression and severity of suicidal thoughts, the

group therapy intervention resulted in significantly reduced rates of repeat occurrences of combined suicidal and nonsuicidal self-harm behavior (6% vs. 32%) by the end of the study.

Two studies evaluated aspects of service utilization in the context of interventions for suicidal youth (Cotgrove et al., 1995; Spirito et al., 2002). Cotgrove and colleagues (1995) examined the impact of providing youth who had been hospitalized with suicide attempts a token allowing readmission to the hospital on demand. The token/hospitalization intervention was developed as an alternative way to escape temporarily from their environment and accordingly, the pressures from the family or home circumstances that might become intolerable. The intervention also recognized the need for youth to be active participants and decision makers in their psychiatric treatment and care. There were no significant differences between groups in suicide attempts recorded in treatment records, although a trend was apparent for lower rate of attempts in the token condition compared to routine care (6% reattempts vs. 12%).

In the second service utilization study, Spirito and colleagues (2002) examined the effectiveness of a compliance enhancement and problem-solving intervention developed to increase adherence to outpatient treatment. In the ED intervention, clinicians fostered appropriate expectations for treatment among both parents and adolescents, reviewed or identified factors that might interfere with treatment adherence, and elicited a contract for attendance for at least four outpatient sessions. At three months, the ED intervention did not result in an overall change in number of treatment sessions attended. However, after controlling for barriers to treatment, the intervention was associated with increased treatment attendance. The effects of the intervention on suicidal behavior were not assessed.

DISCUSSION

Despite public health concern, there are insufficient data available from controlled trials to recommend one intervention over another for the treatment of suicidal youths. To date, however, it appears that interventions for suicidal youth have been in general more successful at affecting aspects of service utilization and delivery (e.g., compliance with medical recommendations, aftercare utilization, reduced hospitalization, decreased time to outpatient appointments) than in reducing rates of suicide attempts per se. That observation notwithstanding, most studies have focused on suicidal youth with heterogeneous clinical presentations, and have been underpowered to detect differences in low base rate outcomes such as suicide attempts.

Mirroring the heterogeneity in clinical presentations of youths, there were marked differences in how outcomes were defined, making it difficult to draw inferences across studies (O'Carroll et al., 1996). For example, outcomes ranged from emergency room admissions for suicidal thoughts and suicidal, life-threatening, or nonsuicidal self-injurious behaviors (Deykin et al., 1986), to the number of suicidal and nonsuicidal self-harm behaviors combined (Katz et al., 2004; Wood et al., 2001), to severity of suicide ideation only (Harrington et al., 1998), to both suicide attempts (operationally defined with at least some intent to die) and severity of suicidal ideation (Donaldson et al., 2005; King et al., 2006; Rotheram-Borus et al., 2000). This diversity of defined outcomes of interest can lead to markedly different inferences both about the prevalence rates of suicide-related behaviors (e.g., Meehan, Lamb, Saltzman, & O'Carroll, 2002) and effectiveness of intervention approaches in reducing these rates or the severity of suicidal outcomes.

Weisz and Hawley (2002) have highlighted the importance of creating developmentally appropriate interventions for adolescents with emotional and behavioral problems. The developmental features in the treatment studies reviewed range from involvement of family or efforts to engage families in the treatment process, to the length of treatment itself, to in-home interventions so that youth can be treated in their natural environments, to incorporation of developmental themes in group and individual therapy. The majority of the interven-

tions attended to individual psychological needs of teenagers by providing support and/or skills training, although it appears that few interventions have focused on the motivation of teenagers to participate in treatment, and modifications made for the cognitive level of adolescents are often not described. In addition, most interventions included family involvement or intervention, although the degree of family involvement in treatment protocols varied dramatically. Although details of interventions are often not well-described, it appears that it has been less common for interventions to explicitly address issues with peers, or to include some attention to the school environment or the school-based setting.

It remains an empirical question as to whether developmental modifications in treatment approach or considerations of developmental context in interventions are directly related to increased effectiveness. Weisz and Hawley (2002), however, have argued that developmentally appropriate therapeutic approaches for adolescents are important for treatment effectiveness because risk and resilience factors, as well as the nature and context of dysfunction, differ in adolescence relative to other developmental periods. The lack of compelling data regarding the relative effectiveness or efficacy of youth suicide interventions raises questions about whether developmental considerations in most interventions to date are adequate. Certainly, developmental appropriateness of interventions may not be sufficient for reducing suicidality, but developmental sensitivity or appropriateness may be an important factor related to increased effectiveness, sustainability, and generalizability of positive therapeutic changes, as well as treatment engagement. In the section that follows, we discuss developmental considerations in interventions for suicidal youths, and suggest future directions for research.

Developmental Trajectories

Most interventions that have been developed for suicidal teenagers have not focused on differences among suicidal youths, but rather have been predicated on the notion that a single approach might be useful for all such youths. Nonetheless, adolescent suicide attempters are a heterogeneous group (Esposito, Spirito, Boergers, & Donaldson, 2003; Goldston et al., 1998; Mandell, Walrath, & Goldston, 2006). The importance of considering the differences among suicidal youth is underscored by patterns of differential response to interventions. For example, in Harrington et al. (1998), youth without depressive disorders showed greater reductions in suicidal thoughts following an in-home family-based intervention relative to routine care. Additionally, in King et al. (2006), girls had greater reductions in suicidal thoughts than boys in response to an adjunctive social support intervention relative to treatment as usual.

Different developmental trajectories also are evident in patterns of suicidal behavior over time among youths. Some youth attempt suicide only once and never think seriously about suicide again. Other youth appear to be more chronically suicidal with persistent morbid ideation and repeated suicide attempts. By definition, youth with different histories of suicidal thoughts and behaviors have different developmental trajectories, and by implication, they likely also have many differences in clinical presentation and history (Esposito et al., 2003; Goldston et al., 1998; Mandell et al., 2006). Other than the Wood et al. (2001) study for youth with repeat self-harm behavior, most interventions have not been tailored for youth with different histories of suicidal behaviors. Different interventions may be needed for youth at greater risk for recurrent suicidal behavior than for youth whose suicidal behavior did not occur in the context of multiple and persistent risk factors.

Conner and Goldston (2007) have suggested that some youth may evidence traits such as impulsivity and aggression that put them at higher risk for developmental failures such as difficulties in interpersonal relationships, school problems, and legal difficulties. Such developmental failures may have a

cascading effect wherein they set the stage for subsequent difficulties, increase the likelihood of distal risk factors for suicide such as depression and substance use, or even serve as proximal risk factors or triggers for suicidal behavior. To reduce the likelihood of suicidal behavior, interventions that target the pattern of difficulties that have emerged over time, and/or try to reduce the likelihood of developmental failures may be useful in reducing recurrent suicidal behavior. In this regard, multisystemic family therapy is an intervention that explicitly focuses on multiple areas of difficulties and the contexts within which behavioral and emotional problems, including suicidal behavior occur (Huey et al., 2004).

Furthermore, most clinicians would readily admit that working with a suicidal 13-year-old is usually a considerably different task than working with a suicidal 19-year-old. However, most interventions have not explicitly acknowledged developmental differences or different levels of maturity, or the different developmental milestones faced by youth at different ages. As such, it is not clear if interventions developed to prevent or deter suicidal behavior among adolescents are always appropriate for use across the entire age span of adolescence.

Relapse Prevention in a Developmental Context

The goals of interventions for suicidal adolescents can be broadly conceived of as reducing current distress (or resolving a current crisis) and preventing episodes of future suicidal behaviors. To the extent that interventions focus on reducing future suicidal behaviors, they are in essence relapse prevention interventions (Esposito-Smythers & Goldston, 2008). For example, the YST intervention (King et al., 2006) is designed to prevent a recurrence of suicidality after hospitalization via the provision of support and encouragement of adherence to treatment. Nonetheless, it is striking that no interventions for suicidal adolescents have been explicitly framed in the language of established

relapse prevention approaches for other problems such as alcohol and substance abuse (e.g., Witkiewitz & Marlatt, 2004).

Developmentally, an implication of a relapse prevention approach is that experience with a specific behavior and the outcomes of the behavior need to be taken into account when planning for the future. For example, in therapy, it often is useful for adolescents to focus on identifying triggers of suicidal thoughts or behavior so they can plan how they will cope more effectively with such situations in the future. The treatments that included a focus on problem-solving skills (Donaldson et al., 2005; Harrington et al., 1998; Katz et al., 2004; Rathus & Miller, 2002; Wood et al., 2001) may facilitate the ability to identify high-risk situations and consideration of behavioral alternatives to suicidal behaviors when youth are faced with difficult or upsetting situations.

Nonetheless, learning is often context-dependent. As such, skills learned when patients are not acutely distressed or suicidal may not generalize to those situations when they are more distressed or at higher risk. For this reason, cognitive therapy approaches developed for adults (Berk, Henriques, Warman, Brown, & Beck, 2004; Brown et al., 2005), but also used with adolescents in the recently completed Treatment of Adolescent Suicide Attempters study (Stanley, 2007) have included exposure tasks to facilitate relapse prevention. In such tasks, patients are asked to reimagine the situations that culminated in their suicide attempts, and then to describe, or imagine how they might deal with such situations differently to avoid suicidality. Such exposures, which could also occur via role playing, might be especially useful for teenagers because they present more "concrete" or specific situations to discuss than more abstract discussions of how to cope with difficulties.

Relapse prevention in the framework of Marlatt and Donovan (2005) is a self-control model. However, younger adolescents in particular often do not have appreciable autonomy. Indeed, at these ages and younger, there is a degree of role captivity

(Pearlin, 1983) in which there may be little opportunity to escape sources of distress, particularly when those stresses are associated with family dynamics or family systems issues (Haggerty, Sherrod, Garmezy, & Rutter, 1994). Hence, efforts at fostering self-control, while meshing with adolescents' struggle for autonomy, need to be tempered with the reality that these youth do not have control over many aspects of their lives. A resulting challenge of therapy is to identify opportunities for enhancing self-esteem and self-control given these constraints. The green card intervention of Cotgrove et al. (1995) provided adolescents a degree of control over rehospitalization, just as the YST intervention provided adolescents with control over the intervention by allowing them to nominate social supports (King et al., 2006). In addition to control over the therapeutic environment, future exploration in intervention development should address ways of establishing or reinforcing adolescents' sense of control and decision making over other aspects of their environment that are appropriate to their developmental level.

Need for Engagement

Suicidal individuals commonly experience ambivalence about participation in treatment and discussions of suicidal behavior. The Rotheram-Borus et al. (2000) and Spirito et al. (2002) studies highlight the potential for brief interventions (e.g., that address mending of the parent-child relationships, or the importance of aftercare, or helping families problem-solve barriers to care) to impact or increase treatment adherence. Nevertheless, these interventions did not specifically address the motivational issues of adolescents that are often associated with treatment drop out. There are a variety of reasons that suicidal adolescents drop out of therapy prematurely. For example, they may experience shame or embarrassment associated with participating in treatment, may have a desire to put the suicidal crisis behind them, may be uncomfortable discussing past suicidal crises or prevention of future diffi-

culties, or may simply believe that a suicidal crisis cannot possibly recur (Goldston, 2003). From a developmental perspective, adolescents may not want to be in therapy because participation underscores the fact that they are different from their peers. In addition, adolescents may fear the reactions of peers if they find out about the attempt. Furthermore, teenagers may be uncomfortable with parental involvement in treatment, particularly when there is conflict between parent and teen or the teen does not want to discuss matters with parents.

Parents likewise may not want their youth to continue in therapy because it implies that their adolescent has a problem, or they may question the necessity of adolescents continuing in treatment after the immediate crisis is over. Parents may reinforce tendencies toward dropping out of therapy when they do not acknowledge the seriousness of what has happened (e.g., labeling the behavior as not serious and/or as manipulative), when they evidence behaviors consistent with shame such as trying to keep the incident a secret, or when their schedules or transportation difficulties make it difficult to consistently bring adolescents to treatment sessions. Therefore, both suicidal adolescents and their parents or guardians need to be engaged in or motivated by the treatment process.

In the treatment of adolescent alcohol and substance use behaviors, brief motivational enhancement therapy approaches have been shown to affect readiness to change and commitment to participation in treatment (Monti, Barnett, O'Leary, & Colby, 2001). Motivational approaches may be well-suited for suicidal adolescents because of the reflective and nonconfrontational stances of therapists which provide validation for adolescents' feelings, but underscore adolescents' sense of control over the process. Moreover, such approaches might help resolve ambivalence regarding the need to be in treatment or the need to make changes in the life circumstances in which the suicide attempt occurred, and may be useful in eliciting directions for treatment directly from the ado-

lescent, and thus, more effectively establishing commitment to change. Motivational approaches also may be useful in increasing the likelihood of follow-through in practicing skills or participating in therapeutic endeavors between and following therapy sessions.

In this regard, in a recent analysis of process variables from a randomized controlled trial of cognitive behavior therapy and nondirective supportive therapy for depressed and suicidal teens (Donaldson et al., 2005), Karver and colleagues (2008) found that there was a strong relationship between therapist alliance with the adolescent and adolescent involvement in treatments. There was a trend for client involvement in treatment, in turn, to be related to the outcome of level of depressive symptoms in CBT but not the nondirective supportive therapy. Variables such as lack of response to or validation of the youths' expression of emotion, in turn, were related to therapist alliance. Although the results of this study should be interpreted with caution given the small sample size, the findings highlight the importance of the therapist-client relationship in maintaining motivation and involvement in treatment, and the need to be especially sensitive to the emotional state of adolescents who have made suicide attempts.

Family Considerations

As mentioned, many interventions for suicidal youth include a focus on family issues, ranging from the home-based interventions (e.g., Harrington et al., 1998; Huey et al., 2004), to the interventions in which parents are enlisted to help as coaches (e.g., Rathus & Miller, 2002), to interventions to facilitate parental follow-through with aftercare recommendations (Rotheram-Borus et al. 2000; Spirito et al., 2002). Family support and involvement is vital to the success of treatment with suicidal youth (Logan & King, 2001). Parents or caregivers are responsible for accessing and maintaining services for youth. Parents are also crucial in establishing and maintaining a viable safety plan includ-

ing parental or caregiver monitoring of the youth and securing of all potential lethal means of harm to self. Family involvement also provides valuable opportunities to educate families about suicidal behavior and psychiatric disorders and to process family conflict (which may be related to the suicidal behavior) with a mental health professional. Family involvement in treatment likewise provides an avenue for family members to develop a plan for how to process or manage future suicidal and risk behaviors.

The issue of validation also can be considered within a family context. A common complaint among adolescents attempting suicide is that "no one understands me" or "no one understands how I feel." As adolescents often are pushing away from their parents as they strive for autonomy, they may be reluctant to share their feelings or experiences with parents. When adolescents share less with parents, it may be difficult for parents to offer support or for their support to be well received. Even among parents who are aware of what is going on in the life of their adolescent, parents may be unsympathetic due to frustration with adolescents' testing of limits, or due to a belief that the adolescent should not even be in certain situations. As described in Linehan's (1993) developmental model, individuals who do not feel validated, particularly if they are temperamentally prone to emotion dysregulation, may be more likely to escalate problem behaviors such as recurrent suicidal behavior. Hence, approaches that help adolescents develop ways of eliciting validation from others or help the parents of adolescents to provide such validation might be useful.

Social Context of Adolescent Suicidal Behavior

Socially, adolescence is a period of transition. Adolescents are learning to negotiate conflicts with their peers with less input and supervision from the adults around them. Teens likewise are relying less on parents for support and relying more on their peers as they grow older (Kerr, Preuss, & King,

2006). In the quest for fitting in and entering relationships beyond the family, adolescents may be especially sensitive to their perceptions of how peers are viewing them. This may put pressure on the adolescents to enter into situations that increase the level of stress, or increase the possibility of rejection, and therein increase the risk of suicidal behavior. In addition, adolescents' emerging sense of self-identify is often rooted in the norms of the chosen peer group. Indeed, many of the peers in a chosen peer group may be troubled themselves or may have engaged in behaviors that may increase the chances of behavioral and emotional difficulties, including suicidal behaviors. For example, peers may imitate or model behaviors that they are exposed to within their peer group or circle of influence. In this regard, Insel and Gould (2008) have noted that youths who are exposed to suicidal behaviors among their peers may be at increased risk for imitating suicidal behaviors. Furthermore, adolescents also are exploring and learning to negotiate romantic and dating relationships. Particularly if they do not have perceived support elsewhere in their lives, the loss of such relationships may be devastating and increase risk for suicidal behaviors.

The Wood et al. (2001) study depended upon a group therapy approach to provide peer support to adolescents, but also included a focus on negotiating conflicts with peers. The YST intervention recognized the importance of social support offered in various contexts (peers, school, religious settings) as a potential buffer to suicidality and a factor affecting treatment utilization (King et al., 2006). As part of a very comprehensive intervention, MST also included a focus on disengaging from problematic peer groups when that is considered relevant to a teen's behavioral and emotional difficulties (Huey et al., 2004). The Deykin et al. (1986) intervention included a focus on education to peer leaders in schools, in recognition of their potential importance in recognizing the difficulties other adolescents are experiencing. Given the importance of peer influences both as supports and risk factors for suicidal behavior, researchers should continue to explore ways of shaping and intervening when appropriate with peer influences, and helping the adolescent to cope with difficult peer situations.

Developmental Strategies for Coping

Several of the interventions described used cognitive behavioral or problem-solving approaches to teach or reinforce adaptive coping skills, and to challenge the negative thinking associated with suicidality. The potential for such approaches is underscored by a study with adults indicating that a brief cognitive behavioral intervention reduced suicide attempts by half (Brown et al., 2005), and from recent results from the Treatment of Adolescents with Depression study (TADS) that indicated that cognitive behavioral approaches were comparable in long-term effectiveness to pharmacotherapy, but reduced the rates of significant suicide ideation and behavior associated with medication (Treatment of Adolescents with Depression study Team, 2007).

Theoretically, most youth should have entered Piaget's cognitive stage of formal operations by early to mid-adolescence (Gruber & Voneche, 1995). This implies that they should be able to think abstractly about issues, reason, and consider the consequences of different courses of action (Gruber & Voneche, 1995). Individuals who are distressed, however, may be particularly prone to more rigid or egocentric thought, and constricted problem-solving ability. In this vein, more concrete aids or coping methods in therapy may be particularly useful with distressed adolescents. One example of a concrete aid is that of coping cards, wherein suicidal adolescents may literally write down on index cards or the inside of a school notebook the coping strategies or coping thoughts that they have discussed and practiced in therapy sessions (Berk et al., 2004). When in difficult situations or becoming distressed, the adolescents may then pull out the written coping statements that remind them of specific strategies or thoughts they may find useful.

Although there are no data available of which we are aware to indicate that the sui-

cide attempts of adolescents are more impulsive than those of adults, many studies have described impulsive suicides or suicidal behavior by adolescents (e.g., Hoberman & Garfinkel, 1988). In addition, teens may engage in impulsive behaviors that precipitate difficulties that then become the occasion for distress or suicidal behaviors. Developmentally, it is worth noting that this impulsivity may occur in the context of general tendencies among some adolescents toward greater risk-taking or reckless behavior and increased arousal that may be related to biological changes during this developmental period (Dahl, 2004). Dahl (2004), for example, cited the sports car metaphor of adolescents sometimes having "strong 'turbo-charged' feelings with a relatively unskilled set of 'driving skills' or cognitive abilities to modulate strong emotions and motivations" (p. 17). Interventions developed for youth to reduce patterns of impulsivity or impulsive problem-solving style may be useful to draw upon in the treatment of suicidal teenagers (D'Zurilla & Nezu, 1999; Kendall & Braswell, 1993). In particular, interventions that support youths' development of abilities to make decisions during periods of high arousal (Dahl, 2004) may be especially useful in reducing impulsivity and risk for suicidal and related behaviors.

Additionally, hopelessness is a predictor of repeat suicidal behavior among adolescents (Goldston et al., 2001), but it is important to realize that adolescents have a different perspective on the future than adults. For example, understandably, when adolescents look to the future, they often are considering the attainment of developmental milestones such as obtaining autonomy from parents, moving away from home, pursuit of post-secondary education, dating relationships, and marriage (Nurmi, 1991). Moreover, adolescents often focus more on short-term rewards than long-term goals in decision-making (Reyna & Farley, 2006). Hence, when working with adolescents, it may be useful to focus on shorter rather than longer-term goals, and/or to focus on developmental milestones as reasons for continuing to live.

One of the major tasks of adolescence is identity development. In this regard, many young people (and even adults) have not yet discovered activities that provide them with a sense of purpose in life. This may be especially important for suicidal individuals, who often experience "tunnel-vision" or profound difficulty stepping back from a single-minded focus on their psychic pain or inability to deal with a difficult situation (Shneidman, 1996). To counter such tendencies, it may be useful for therapists to encourage adolescents to participate in activities that involve helping other people (e.g., volunteerism) in an effort to help adolescents to gain perspective on their problems, develop their assets or strengths, and to foster "meaning" in their lives (Ellis & Newman, 1996). In addition, helping others allows the adolescent to expand their social network and supports. Research has shown that volunteerism in adolescents is associated with a number of positive outcomes including higher self-esteem, higher educational aspirations, and higher academic motivation (Johnson, Beebe, Mortimer, & Snyder, 1998).

Lastly, youth spend much of their lives in school or involved in school-related activities, and indeed, academic difficulties may increase risk for suicidal behaviors (Daniel et al., 2006). Provision of treatment for suicidal youth in school settings (e.g., through school-based clinics) may be helpful in expanding positive social support networks for at-risk youths, fostering school connectedness and addressing sources of stress within the school, overcoming barriers to treatment, and providing a natural environment or setting in which strategies for coping can be practiced, with more immediate feedback from mental health professionals than might be available otherwise. Future intervention research should more fully explore ways of addressing the school context of adolescent suicidal behaviors.

CONCLUSIONS

In summary, there is limited evidence to date of the effectiveness of interventions in reducing suicide attempts. Given the het-

erogeneity among adolescent suicide attempters, it is unlikely that a "one size fits all" approach to treatment will prove effective for suicidal youth. In addition, given that multiple developmental contexts are associated with adolescent suicidal behavior, it may be that interventions that affect multiple contexts of at-risk behaviors (e.g., family, peer, academic) may yield more generalizable and sustainable effects than interventions that are not sensitive to the developmental contexts and nuances of adolescence. Recognition and consideration of the developmental and contextual factors associated with adolescent suicidal behavior will help researchers in devel-

oping the next generation of interventions for suicidal teens and will help clinicians in implementing developmentally sensitive care in the treatment of suicidal behaviors among adolescents. While this paper highlights the specific developmental and contextual factors important to consider in relation to adolescent suicidal behavior, future research is needed to explore the unique developmental and contextual considerations for treatment of suicidal behaviors specific to each stage of life (e.g., adolescence, young adulthood, middle age, late life) given that development continues across the lifespan.

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Suicide and Suicidal Behavior

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Abstract

Suicidal behavior is a leading cause of injury and death worldwide. Information about the epidemiology of such behavior is important for policy-making and prevention. The authors reviewed government data on suicide and suicidal behavior and conducted a systematic review of studies on the epidemiology of suicide published from 1997 to 2007. The authors' aims were to examine the prevalence of, trends in, and risk and protective factors for suicidal behavior in the United States and cross-nationally. The data revealed significant cross-national variability in the prevalence of suicidal behavior but consistency in age of onset, transition probabilities, and key risk factors. Suicide is more prevalent among men, whereas nonfatal suicidal behaviors are more prevalent among women and persons who are young, are unmarried, or have a psychiatric disorder. Despite an increase in the treatment of suicidal persons over the past decade, incidence rates of suicidal behavior have remained largely unchanged. Most epidemiologic research on suicidal behavior has focused on patterns and correlates of prevalence. The next generation of studies must examine synergistic effects among modifiable risk and protective factors. New studies must incorporate recent advances in survey methods and clinical assessment. Results should be used in ongoing efforts to decrease the significant loss of life caused by suicidal behavior.

Keywords

Introduction

Suicide is an enormous public health problem in the United States and around the world. Each year over 30,000 people in the United States and approximately 1 million people worldwide

die by suicide, making it one of the leading causes of death (1–3). A recent report from the Institute of Medicine (National Academy of Sciences) estimated that in the United States the value of lost productivity due to suicide is $11.8 billion per year (4). Reports from the World Health Organization (WHO) indicate that suicide accounts for the largest share of the intentional injury burden in developed countries (5) and that suicide is projected to become an even greater contributor to the global burden of disease over the coming decades (6,7). The seriousness and scope of suicide has led both the WHO (8) and the US government (2,3) to call for an expansion of data collection on the prevalence of and risk factors for suicide and nonfatal suicidal behavior to aid in the planning of public-health strategies and health-care policies and in the monitoring of behavioral responses to policy changes and prevention efforts.

Addressing these calls, in this paper we provide a review of the epidemiology of suicidal behavior and extend earlier reviews in this area (9–21) in two important ways. First, we provide an update on the prevalence of suicidal behavior over the past decade. The socioeconomic and cultural factors with which suicidal behavior is associated, such as the quality and quantity of mental health services, have changed dramatically (22,23), making it important to examine whether and how the prevalence of suicidal behavior has changed over time. Second, most prior reviews have focused on a specific country (e.g., the United States), subgroup (e.g., adolescents), or behavior (e.g., suicide attempts). We review data from multiple countries, on all age groups, and on different forms of suicidal behavior, providing a comprehensive picture of the epidemiology of suicidal behavior. Moreover, given recent technologic developments in injury surveillance systems (24), as well as the recent completion of several large-scale epidemiologic studies examining the cross-national prevalence of suicidal behavior (25–28), an updated review of this topic is especially warranted at this time.

Terminology and definitions in suicide research

We use the terminology for and definitions of suicidal behavior outlined in recent consensus papers on this topic (29–32). We define *suicide* as the act of intentionally ending one's own life. Nonfatal suicidal thoughts and behaviors (hereafter called "suicidal behaviors") are classified more specifically into three categories: *suicide ideation*, which refers to thoughts of engaging in behavior intended to end one's life; *suicide plan*, which refers to the formulation of a specific method through which one intends to die; and *suicide attempt*, which refers to engagement in potentially self-injurious behavior in which there is at least some intent to die. Most researchers and clinicians distinguish suicidal behavior from nonsuicidal self-injury (e.g., self-cutting), which refers to self-injury in which a person has no intent to die; such behavior is not the focus of this review (33–35).

We first review data on the current rates of and recent trends in suicide and suicidal behavior in the United States and cross-nationally. Next we review data on the onset, course, and risk and protective factors for suicide and suicidal behavior. Finally, we summarize data from recent suicide prevention efforts and conclude with suggestions for future research.

Materials and Methods

Main data sources

Suicide—Data on annual suicide mortality in the United States are maintained by the National Vital Statistics System of the Centers for Disease Control and Prevention (CDC) and were retrieved for this review using the Web-based Injury Statistics Query and Reporting System (WISQARS) (36). In examining recent time trends, we examined rates of suicide in the United States from 1990–2005, the most recent data currently available. Suicide data for many other countries are maintained by the WHO (8). We included information in this review from a wide range of countries and for those countries with the highest reported rates of suicide, but we did

not include data for every country because of space constraints. Cross-national variability in the most recent year for which suicide data were available precluded an analysis of recent trends at the same level of detail as that for the United States.

Suicidal behavior—The CDC also maintains data on the estimated rate of nonfatal self-injury based on a national surveillance system of injuries treated in US hospital emergency departments (the National Electronic Injury Surveillance System) (37). We reviewed these data to estimate the rate of nonfatal self-injury in the United States. Although these data provide valuable information about the scope of this problem, they have three notable limitations: They lack precision in that they do not distinguish between suicidal and nonsuicidal self-injury; they do not provide data on characteristics or risk or protective factors; and they fail to capture self-injury not treated in US hospital emergency departments. In order to address these limitations, we also obtained data on the prevalence and characteristics of nonfatal suicidal behavior in the United States and other countries via a systematic electronic search of the recent peer-reviewed literature (1997–2007). We searched the US National Library of Medicine's PubMed electronic database using the title and abstract search terms "suicide," "suicidal behavior," and "suicide attempt" and requiring the term "epidemiology" or "prevalence." This search yielded 1,052 abstracts, which we reviewed individually. We used these articles to inform the review if the authors reported the prevalence of suicide ($n = 28$) or suicidal behavior ($n = 65$) within some well-defined population, reported on risk/protective factors or prevention programs ($n = 132$), or provided a review of studies on one or more of the aforementioned topics ($n = 102$). Excluded were studies with small sample sizes (<100; $n = 73$), studies for which the full article was not available in English ($n = 108$), studies of narrowly defined subpopulations (e.g., specific clinical samples) or irrelevant topics (e.g., cellular suicide) ($n = 493$), and studies that did not provide a specific measure of one of the suicidal behaviors outlined above ($n = 51$). When we identified multiple articles reporting on the same data source (e.g., the CDC Youth Risk Behavior Survey), we used only the primary or summary report to avoid redundancy.

Results

Suicide in the United States

Current rates—In the United States, suicide occurs among 10.8 per 100,000 persons, is the 11th-leading cause of death, and accounts for 1.4 percent of all US deaths (36). A more detailed examination of the data by sex, age, and race/ethnicity reveals significant sociodemographic variation in the suicide rate. As figure 1 illustrates, there are no group differences until mid-adolescence (ages 15–19 years), at which time the rate among males increases dramatically relative to the rate among females. The rise for males is greatest among Native Americans/ Alaskan Natives, increasing more than fivefold during adolescence and young adulthood, from 9.1 per 100,000 (ages 10–14 years) to 51.9 per 100,000 (ages 20–24 years). The rate for Native American/Alaskan Native males declines during middle adulthood before peaking again during older age. Non-Hispanic White males also have a sharp increase during adolescence and young adulthood (from 2.0/100,000 at ages 10–14 years to 23.0/100,000 at ages 20–24 years) and a second one from ages 65–69 years (23.9/100,000) to age 85 years or more (49.7/100,000). The rates for women are lower and virtually nonoverlapping with those of men, with two exceptions being suicide among Native American/Alaskan Native women during adolescence (ages 10– 19 years) and suicide for White women during middle age (ages 55–59 years). Suicide rates for people of Hispanic and Asian race/ethnicity, not presented in figure 1 because of space constraints, were generally similar to those for Black males and females.

Recent trends—Figure 2 depicts recent trends (1990–2005) in rates of suicide in the United States, with separate lines plotted by sex (male/female) and age group (10–24, 25–44, 45–64, or ≥65 years). Suicide rates stratified by race/ethnicity did not change during this time period

and so were not included for ease of presentation. As the figure shows, the suicide rate is consistently higher for males than for females. Substantive decreases have occurred for elderly males (ages ≥65 years), who show a decrease from 41.4 per 100,000 to 29.5 per 100,000, and for young males (ages 10–24 years), who show a decrease from 15.7 per 100,000 to 11.4 per 100,000. The overall US suicide rate decreased from 12.4 per 100,000 to 11.0 per 100,000 (an 11.1 percent decrease) during this time.

Cross-national suicide rates

Current rates—International data from the WHO indicate that suicide occurs in approximately 16.7 per 100,000 persons per year, is the 14th-leading cause of death worldwide, and accounts for 1.5 percent of all deaths (8). As figure 3 illustrates, suicide rates vary significantly cross-nationally. In general, rates are highest in Eastern Europe and lowest in Central and South America, with the United States, Western Europe, and Asia falling in the middle. Despite the wide variability in rates, there is a consistently higher rate among men than among women, with men more often dying by suicide at a ratio of 3:1–7.5:1. Two notable exceptions are India and China, where there are no clear sex differences. The male:female ratio is 1.3:1 in India, 0.9:1 in mainland China, and 2.0:1 in Hong Kong. The reason for the absence of a sex difference in India and mainland China is not known, but it has been suggested that the lower social status of females in the context of disempowering circumstances and the more lethal methods used in these countries, such as self-burning in India (38) and ingestion of pesticides in China (39), may account for this pattern. Given that India and China alone constitute nearly half of the world's population, this "atypical" ratio may well represent a typical pattern when considered on the basis of the global population.

Recent trends—Definitive data do not exist on worldwide trends in suicide mortality because of cross-national differences in reporting procedures and data availability. The WHO has maintained cross-national data on suicide mortality since 1950; however, there are inconsistencies in reporting by individual country, with only 11 countries providing data in 1950, 74 in 1985, and 50 in 1998. Moreover, the fact that some governments have treated suicide as a social or political issue rather than a health problem may have diminished the validity of earlier data and resulting estimates. Given these inconsistencies, it is difficult to generate an accurate cross-national estimate of trends. Nevertheless, the data maintained by the WHO suggest that the global rate of suicide increased between 1950 and 2004, especially for men (40), and data-based projections suggest that the number of self-inflicted deaths will increase by as much as 50 percent from 2002 to 2030 (7). Given the inconsistencies in data sources both within and across countries (40–42), though, a definitive picture of long-term trends in global suicide death cannot be formed.

Suicidal behavior in the United States

Current rates—Figure 4 presents CDC data (37) on nonfatal self-injury in the United States for 2006, by age group. There is a significant increase in risk of nonfatal self-injury (both suicidal and nonsuicidal in nature) during adolescence and young adulthood which then decreases monotonically throughout adulthood. In contrast to suicide mortality, rates of nonfatal self-injury are consistently higher among females. Data from our systematic review suggest that for US adults (ages ≥18 years), the lifetime prevalence of suicide ideation is 5.6–14.3 percent, with an interquartile range (IQR) of 7.9–13.9. For suicide plans, the lifetime prevalence is 3.9 percent, and for suicide attempts it is 1.9–8.7 percent (IQR, 3.0–5.1) (see table 1 for studies). Twelve-month prevalence estimates are in the range of 2.1–10.0 percent (IQR, 2.4–6.7) for suicide ideation, 0.7–7.0 percent (IQR, 0.7–5.5) for suicide plans, and 0.2–2.0 percent (IQR, 0.3–1.3) for suicide attempts, with higher rates for younger adults and females (table 1). Some of the variation in rates is probably due to sample selection (e.g., a high rate of attempts in the study including only Native Americans) and variability in the methods used

to assess suicidal behaviors. For instance, questions asking about "thoughts of death" generate higher prevalence estimates for suicide ideation than questions asking about "seriously considering suicide" (43), and questions requiring endorsement of an intent to die from self-injury yield lower estimates of suicide attempts than questions asking simply whether a person has made a "suicide attempt" (34).

Studies in adolescents (ages 12–17 years) suggest that lifetime prevalences are in the range of 19.8–24.0 percent (IQR, 19.8–24.0) for suicide ideation and 3.1–8.8 percent (IQR, 3.1–8.8) for suicide attempts (there are no lifetime data on suicide plans). Twelve-month prevalence estimates are in the range of 15.0–29.0 percent (IQR, 16.9–24.1) for suicide ideation, 12.6–19.0 percent (IQR, 13.8–18.2) for suicide plans, and 7.3–10.6 percent (IQR, 8.0–8.8) for suicide attempts (table 1).

A comparison of the prevalence estimates for suicidal behavior between adults and adolescents raises the question of how it is possible that adults have a *lower* lifetime prevalence than adolescents. In fact, the lifetime prevalence of each individual suicidal behavior among adults is lower than the 12-month prevalence among adolescents. One possible explanation is that the rates of suicidal behavior in the United States are increasing dramatically among adolescents, but this is inconsistent with data on trends in adolescent suicide (reviewed above) and suicidal behaviors (reviewed below). A more likely explanation is that adults underreport lifetime suicidal behaviors. Evidence of such a bias was found in a study by Goldney et al. (44), in which 40 percent of adolescents who initially reported suicide ideation at one time point denied any lifetime history of suicide ideation when interviewed 4 years later as young adults.

Recent trends—CDC data (37) from 2001–2006 are available for comparison. As figure 5 shows, the rate of nonfatal self-injury (both suicidal and nonsuicidal in nature) increased during this period. Each age and sex group examined showed an increase, and the overall rate increased from 113.4 per 100,000 to 132.0 per 100,000 (16.5 percent). Data from our systematic review suggested that the estimated 12-month prevalence of suicidal behaviors among adults in the United States has remained stable in recent years. One recent study revealed that although use of health-care services increased dramatically among suicidal adults in the decade between 1990–1992 and 2001–2003, the 12-month prevalence did not change significantly for suicide ideation (2.8 percent→3.3 percent), suicide plans (0.7 percent→1.0 percent), or suicide attempts (0.4 percent→0.6 percent) (22). Data on the 12-month prevalence of suicidal behaviors among adolescents from the CDC Youth Risk Behavior Survey are more encouraging and indicate that from 1991 to 2005 there was a decrease in the rates of suicide ideation (29.0 percent→16.9 percent) and plans (18.6 percent→13.0 percent) but no such decrease for attempts (7.3 percent→8.4 percent) (45).

Onset and course—The earliest onset ever reported for suicidal behaviors is in children as young as 4–5 years (21,46–50). However, some authors have argued that children younger than 10 years are rarely capable of understanding the finality of death and therefore cannot make a suicide attempt (51,52). The most consistently reported pattern is that the risk of first onset for suicidal behavior increases significantly at the start of adolescence (12 years), peaks at age 16 years, and remains elevated into the early 20s. This means that adolescence and early adulthood are the times of greatest risk for first onset of suicidal behavior (47,53). Early stressors such as parental absence and family history of suicidal behavior have been associated with an earlier age of onset (53,54).

Relatively few investigators have examined the course of suicidal behaviors. Data using retrospective recall of age of onset suggest that 34 percent of lifetime suicide ideators go on to make a suicide plan, that 72 percent of persons with a suicide plan go on to make a suicide attempt, and that 26 percent of ideators without a plan make an unplanned attempt (47). The

majority of these transitions occur within the first year after onset of suicide ideation (60 percent for planned first attempts and 90 percent for unplanned first attempts) (47). These findings indicate that the presence of suicide ideation and a suicide plan significantly increase the risk of a suicide attempt and that risk of a suicide attempt among persons without a plan is limited primarily to the first year after onset of suicide ideation. Prior suicidal behaviors are among the strongest predictors of subsequent suicidal behaviors (4,55–57); however, suicide ideation in the continued absence of a plan or attempt is associated with decreasing risk of suicide plans and attempts over time (58).

Suicidal behavior cross-nationally

Current rates—As with suicide death, there is considerable cross-national variability in the prevalence of suicidal behaviors. Across all studies identified that assessed lifetime prevalence among adults in individual countries, estimates varied widely for suicide ideation (3.1–56.0 percent; IQR, 8.0–24.9), suicide plans (0.9–19.5 percent; IQR, 1.5–9.4), and suicide attempts (0.4–5.1 percent; IQR, 1.3–3.5). Estimates of the 12-month prevalence of suicidal behaviors among adults also showed wide variability for suicide ideation (1.8–21.3 percent; IQR, 2.4–8.8), plans (0.5–12.2 percent; IQR, 0.9–6.2), and attempts (0.1–3.8 percent; IQR, 0.4–1.5). As in the United States, prevalence estimates were consistently higher among adolescents for the lifetime prevalence of suicide ideation (21.7–37.9 percent; IQR, 21.7–37.9), plans (3.0 percent; one study), and attempts (1.5–12.1 percent; IQR, 2.2–8.8), as well as for the 12-month prevalence of suicide ideation (11.7–26.0 percent; IQR, 14.8–22.9), plans (5.0–15.0 percent; IQR, 5.0–15.0), and attempts (1.8–8.4 percent; IQR, 2.7–4.7) (table 1).

One important limitation in comparing results across studies of suicidal behavior is that different studies use different questions to assess these behaviors, so it is not clear how much of the variability observed across studies is due to differences in measurement methods. In three recent cross-national studies, investigators have attempted to remedy this problem by using consistent measurement strategies across countries. These are: 1) the WHO/EURO Multicentre Study on Parasuicide ($n = 22,665$) (28,59,60), which included persons engaging in "parasuicide" (i.e., combining suicidal and nonsuicidal self-injury) who were treated at medical centers in 15 European countries; 2) the WHO Multisite Intervention Study on Suicidal Behaviours ($n = 69,797$) (27,61,62), which included community samples in eight countries; and 3) the WHO World Mental Health Survey, which provides data on the epidemiology of suicidal behaviors in 28 countries in the Americas, Europe, Asia, Africa, the Middle East, and the Pacific. Interestingly, all three studies revealed wide cross-national variation in suicidal behaviors. For instance, analyses for the first 17 World Mental Health Survey countries ($n = 84,850$) yielded prevalence estimates for suicide ideation (3.0–15.9 percent; IQR, 4.4–11.7), plans (0.7–5.6 percent; IQR, 1.6–4.0), and attempts (0.5–5.0 percent; IQR, 1.5–3.2) that were consistent with those reviewed above. The pooled cross-national prevalence estimates in this study were: for suicide ideation, 9.2 percent (standard error, 0.1); for suicide plans, 3.1 percent (standard error, 0.1); and for suicide attempts, 2.7 percent (standard error, 0.1) (25) (table 1). Interestingly, rates of suicidal behavior do not mirror the geographic pattern reported for suicide death (e.g., high rates in Eastern Europe, low rates in South America), nor do they differ systematically between developed and developing countries (25).

Recent trends—Our search did not yield any cross-national studies of trends in suicidal behavior. However, it is notable that the prevalence estimates found in the studies we reviewed are quite consistent with those obtained in an earlier cross-national review of nine studies of adult suicidal behavior conducted in the 1980s (26)—suggesting, but by no means confirming, that there has been no major change in trends over time. Trends in suicidal behavior within individual countries also appear to have been fairly steady over time (22,58,63,64). The fact that within-country trends show internal consistency (i.e., greater agreement on prevalence

estimates and evidence of stable patterns over time) means that there must be some stable between-country differences in the determinants of suicidal behavior prevalences and trends that remain to be discovered.

Onset and course—Data on the onset and course of suicidal behaviors appear to be quite consistent cross-nationally and look similar to the previously mentioned data from studies in the United States. Data from the World Mental Health Survey indicate that for all countries examined, the risk of first onset of suicide ideation increases sharply during adolescence and young adulthood and then stabilizes in early midlife (25). There is consistency in the timing and probability of transitioning from suicide ideation to suicide plans and attempts, with 33.6 percent of ideators going on to make a suicide plan (IQR, 29.8–35.6) and 29.0 percent of ideators making an attempt (IQR, 21.2–33.1) (25). In addition, the high risk of transitioning from ideation to a plan and an attempt during the first year after ideation onset that was found in the United States (47) was replicated across all countries examined, with the transition from ideation to an attempt occurring during the first year more than 60 percent of the time across all countries (25). These findings indicate that the onset and course of suicidal behaviors are quite consistent cross-nationally.

Risk factors

Below, we review evidence on risk factors for both suicide and suicidal behaviors, given the substantial overlap in the risk factors reported to predict these behaviors (34,65), although we note that several studies have reported differences in some risk factors for suicide and suicidal behaviors (66,67). Most of the studies reviewed above also contained information about risk factors for suicidal behaviors. We do not distinguish between studies conducted in different countries, given that the risk factors reported have been consistent across virtually all countries examined. Given that there is a large and ever-expanding body of literature on risk factors for suicidal behaviors, we provide a summary of only the strongest and most consistently reported factors.

Demographic factors—Demographic risk factors for suicide include male sex, being non-Hispanic White or Native American (in the United States), and being an adolescent or older adult. Demographic risk factors for suicidal behaviors (in the United States and cross-nationally) include being female, being younger, being unmarried, having lower educational attainment, and being unemployed (25–28,40,68). The differences in male:female ratio are often attributed to the use of more lethal suicide attempt methods, greater aggressiveness, and higher intent to die among men (34,69). As mentioned above in connection with India and China, the gender-specific lethality of methods may vary cross-nationally. The other demographic factors mentioned (younger age, lack of education, and unemployment) may represent increased risk for suicidal behaviors associated with social disadvantage, although the mechanisms through which these factors may lead to suicidal behavior are not yet understood.

Psychiatric factors—The presence of a psychiatric disorder is among the most consistently reported risk factors for suicidal behavior (25,47,70–74). Psychological autopsy studies reveal that 90–95 percent of the people who die by suicide had a diagnosable psychiatric disorder at the time of the suicide (75), although this percentage is lower in non-Western countries such as China (76,77). Mood, impulse-control, alcohol/substance use, psychotic, and personality disorders convey the highest risks for suicide and suicidal behavior (25,34,47,70,71,78–81), and the presence of multiple disorders is associated with especially elevated risk (25,47,80, 82).

Psychological factors—Researchers have begun to examine more specific constructs that may explain exactly *why* psychiatric disorders are associated with suicidal behavior. Several such risk factors include the presence of hopelessness (83–85), anhedonia (49,86), impulsiveness (70,87–89), and high emotional reactivity (86,87,90), each of which may increase psychological distress to a point that is unbearable and lead a person to seek escape via suicide (88,91–93).

Biologic factors—Family, twin, and adoption studies provide evidence for a heritable risk of suicide and suicidal behavior (94–99). Much of the family history of suicidal behavior may be explained by the risk associated with mental disorders (100); however, some studies have provided evidence for familial transmission of suicidal behavior even after controlling for mood and psychotic disorders (101). Researchers have not identified genetic loci for suicide in molecular genetic studies in light of the complex nature of the phenotype (102,103) but instead have searched for biologic correlates of suicidal behavior that may arise through gene-environment interactions (104–109). The biologic factors most consistently correlated with suicidal behavior involve disruptions in the functioning of the inhibitory neurotransmitter serotonin. Persons who die by suicide have lower levels of serotonin metabolites in their cerebrospinal fluid (110–113), higher serotonin receptor binding in platelets (114,115), and fewer presynaptic serotonin transporter sites and greater postsynaptic serotonin receptors in specific brain areas such as the prefrontal cortex (101,116), suggesting deficits in the ability to inhibit impulsive behavior (101,117). Notably, however, similar deficits in serotonergic functioning are found in other impulsive/aggressive behaviors such as violence and fire-setting (118) and appear to be nonspecific to suicide.

Stressful life events—Most theoretical models of suicidal behavior propose a diathesis-stress model in which the psychiatric, psychological, and biologic factors above predispose a person to suicidal behavior, while stressful life events interact with such factors to increase risk. Consistent with such a model, suicidal behaviors often are preceded by stressful events, including family and romantic conflicts and the presence of legal/disciplinary problems (72, 76,119,120). The experience of persistent stress also may explain why persons in some occupations, such as physicians (121), military personnel (122–125), and police officers (126), may have higher rates of suicidal behavior; however, this increased risk may be explained by the demographic and personality characteristics of people who select such occupations (125,127). More distal stressors, such as perinatal conditions and child maltreatment, also have been linked to subsequent suicidal behavior (128–132). One goal for future research is to begin to specify the mechanisms through which such factors may increase risk.

Other factors—The list of risk factors outlined above is not exhaustive, and there is emerging evidence for a range of other factors, including access to lethal means such as firearms and high doses of medication (66,127,133–135), chronic or terminal illness (136,137), homosexuality (138–140), the presence of suicidal behavior among one's peers (141–144), and time of year (with higher rates consistently being reported in May and June) (145–148). Improvement in the ability to predict suicidal behavior through the continued identification of specific risk factors represents one of the most important directions for future studies in this area.

Protective factors

Protective factors are those that decrease the probability of an outcome in the presence of elevated risk. Although formal tests of protective factors are rare in the suicide research literature, several studies of factors associated with lower risk of suicidal behavior have yielded interesting results. Religious beliefs, religious practice, and spirituality have been associated

with a decreased probability of suicide attempts (149–152). Potential mediators of this relation, such as moral objections to suicide (153) and social support (154), also seem to protect against suicide attempts among persons at risk. Perceptions of social and family support and connectedness also have been studied outside the context of religious affiliation and have been shown to be significantly associated with lower rates of suicidal behavior (155–159). Being pregnant and having young children in the home also are protective against suicide (160, 161); however, the presence of young children is associated with a significantly *increased* risk of first onset of suicidal ideation. These findings highlight the importance of attending carefully to the dependent variable in question when examining risk and protective factors for suicidal behavior.

Prevention/intervention programs

The relatively stable rates of suicide and suicidal behavior over time highlight the need for greater attention to prevention and intervention efforts. A recent systematic review of suicide prevention programs revealed that restricting access to lethal means and training physicians to recognize and treat depression and suicidal behavior have shown impressive effects in reducing suicide rates (135). Means-restriction programs can decrease suicide rates by 1.5–23 percent (162–166), while primary-care physician education and training programs show reductions of 22–73 percent (167–170). Although effective prevention programs exist, the fact that many people engaging in suicidal behavior do not receive treatment of any kind (22,171–173) underscores the need for greater dissemination of information and further development of prevention efforts (41,174,175).

Discussion

Summary of findings

The past decade of research on the epidemiology of suicide has yielded several key findings. First, global estimates suggest that suicide continues to be a leading cause of death and disease burden and that the number of suicide deaths will increase substantially over the next several decades. Second, the significant cross-national variability reported in rates of suicide and suicidal behavior appears to reflect the true nature of this behavior and is not due to variation in research methods. Third, there is cross-national consistency in the early age of onset of suicide ideation, the rapid transition from suicidal thoughts to suicidal behavior, and the importance of several key risk factors. Fourth, despite significant developments in treatment research and increased use of health-care services among suicidal persons in the United States, there appears to have been little change in the rates of suicide or suicidal behavior over the past decade.

The 11.1 percent decrease in the US suicide rate since 1990 is encouraging. Enthusiasm is tempered, however, by knowledge of the fact that the suicide rate is currently at approximately the same level as in 1950 and even 1900, with periodic fluctuation between 10.0 per 100,000 and 19.0 per 100,000 over the past 100 years (4,9,176). Similar stable patterns have been observed in other countries (177). Moreover, data on nonfatal self-injury show a 16.5 percent increase in such behavior in only the past 6 years, especially for youth. It is possible that the decrease in youth suicide over this period coupled with the increase in nonfatal self-injury treated in emergency departments is the result of decreased lethality of youth suicidal behavior (perhaps due to safer medication and less access to firearms). An alternative possibility is that the increase in nonfatal self-injury is explained largely by increases in the occurrence of nonsuicidal self-injury. More careful assessment of the intent behind self-injury is needed to address this question. Regardless of the ultimate answers to these questions, it is clear that major advances are needed to enhance understanding of the causes of suicidal behavior and to further decrease the loss of life due to suicide.

Research directions

The next generation of epidemiologic studies in this area must move beyond reporting of prevalence estimates and known risk factors. Below we review several developing lines of investigation that could be used to improve research on the epidemiology of suicidal behavior. In doing so, we propose an agenda for future studies in this area that addresses many existing gaps in our understanding of suicidal behavior.

Testing theoretical models—There is no debate among epidemiologists and clinical investigators that suicidal behaviors are complex, multiply determined phenomena, yet most investigators continue to test bivariate associations between atheoretical demographic or psychiatric factors and suicidal behaviors, with little regard for existing theoretical models. Several notable exceptions exist, such as the testing of diathesis-stress models (70) and gene-environment interactions (106). True advances in understanding of suicidal behaviors are likely to come only through increased testing of these and other models.

A related issue is that while most studies examining suicide ideation, plans, and attempts have shown that similar risk factors predict these outcomes, virtually no studies have more specifically tested which factors predict transitions from ideation to plans and attempts. Such an approach has been useful in other areas, such as the study of drug and alcohol problems—where, for instance, factors that predict ever drinking differ from those that predict development of a drinking problem among drinkers, which in turn differ from those that predict alcohol dependence among problem drinkers (178–180). In the suicide literature, interventions that reduce rates of suicide attempts often do not show similar reductions in ideation (181,182), suggesting that their effect may lie in decreasing the probability of transitioning from ideation to an attempt rather than in reducing ideation altogether. Understanding this kind of specificity can help us strengthen theories about causal processes and develop more effective interventions.

Incorporating methodological advances—Key methodological obstacles in the study of suicidal behavior include the low base rate of suicidal behavior and the motivation to conceal suicidal thoughts and intentions. These problems have hindered suicide research for decades; however, recent methodological advances now offer novel solutions, outlined below.

<u>Low base-rate problem:</u> New developments in survey methodology make it easier than ever before to conduct large surveys using inexpensive methods such as interactive voice-response telephone surveys (183–185) and Web-based surveys (186–188). These methods are most effective when respondents have a known relationship to the researchers, as in the case of clinical samples. Although clinical epidemiology is an underdeveloped research area, advances in the use of electronic medical records and electronic clinical decision support tools will almost certainly lead to an expansion of this field. Prospective research on risk and protective factors for suicide and suicidal behavior could be dramatically improved by such developments.

One important direction is using such methods to study high-risk samples prospectively. For instance, given that nearly 20 percent of high-school students report 12-month suicide ideation and that suicide is the second-leading cause of death among college students in the United States, researchers could screen large samples of college students before their first semester, identify those with recent suicide ideation, and follow that group over time in order to identify risk factors for suicide attempts in this high-risk group. The structure of the college setting (e.g., the availability of the Internet and e-mail, the 4-year time line) greatly increases the feasibility of such studies. On a larger scale, given that approximately 3 percent of US adults report 12-month suicide ideation, resources like the CDC Behavioral Risk Factor Surveillance System (189), which interviews over 350,000 people per year, could identify 10,500 suicide

ideators who could be followed prospectively to examine risk factors for a suicide attempt. Psychological autopsy studies could be done with a matched control group of nonattempting ideators; this would yield valuable information about more specific risk factors for suicide. These are only a few of the many directions now possible, given these exciting technologic advances.

Detection of suicidal behavior: Researchers studying sensitive and potentially shameful topics such as illicit drug use, sexual practices, and suicidal behavior have long realized that people often underreport such behavior in order to avoid embarrassment or intervention (190). Methods for limiting the influence of social desirability include using computer-based interviews (191), presenting survey items in written form rather than reading them aloud (192), and using anonymous surveys, which have been shown to yield rates of suicidal behavior as much as 2–3 times higher than those of nonanonymous surveys (193,194). Another important advance is the development of behavioral methods for assessing implicit thoughts about self-injurious behavior. Methods have recently been developed that use a person's response times to self-injury-related stimuli presented in a brief computer-based test to measure implicit associations with self-injury. Such tests circumvent the use of self-reporting and have been shown to accurately detect and predict suicidal behavior (195,196). Such methods could be used to supplement self-reports and to test the percentage of cases identified via behavioral methods that also are detected by standard self-report methods to gain a better understanding of the current extent of underreporting of suicidal behavior.

Conducting epidemiologic experiments—Perhaps one of the most important directions for research on the epidemiology of suicidal behavior is increased use of epidemiologic experiments on prevention and intervention procedures. Such studies serve multiple purposes. First, they allow for tests of causation that are not possible with the correlational designs that dominate this area of research. Second, they address the biggest shortcoming in suicide research to date: the inability to dramatically decrease rates of suicidal behavior and mortality despite decades of research and associated commitment of resources.

As a preliminary step, descriptive data are needed on rates of treatment utilization among persons exhibiting suicidal behavior, including data on treatment adequacy and the presence of potentially modifiable barriers to treatment (197,198). Following this, efforts will be required to build on findings from recent natural experiments, quasi-experiments, and true experiments on methods of suicide prevention (135).

Natural experiments: Changes in social policy or historical events provide valuable opportunities to study factors that may influence suicidal behavior. For instance, one of the biggest controversies in the study and treatment of suicidal behavior is whether the recent development of selective serotonin reuptake inhibitors (SSRIs) has led to a decrease, or a paradoxical increase, in suicidal behavior among children and adolescents. Epidemiologists are perfectly poised to test this question, especially given advances in the development and maintenance of electronic health records. Several studies have documented a decrease in suicide following the development of SSRIs and associated with the prescription of SSRIs (199–202). However, there has recently been a decrease in the prescription of SSRIs to US children and adolescents following an observed increase in suicide among adolescents taking SSRIs and the issuance of a "black box" warning (a label on the medication package insert indicating possible adverse effects) by the Food and Drug Administration (203,204). Epidemiologic studies are under way to test differences in suicide trends before and after implementation of the black box warning as mediated by disaggregated changes in levels of SSRIs prescribed to youth.

Quasi-experiments: Quasi-experimental designs strengthen the case for causality and are a useful alternative when true experiments are not feasible, as is often the case in epidemiologic research. One recent example from the suicide literature is the test of the US Air Force Suicide Prevention Program, which was shown to reduce the rate of suicide death by 33 percent within this population (205). Many services currently provided to the public for the purposes of suicide prevention (e.g., suicide hotlines, inpatient hospitalization) have not been adequately tested. Epidemiologic quasi-experimental studies could begin to address services provided in such settings.

True experiments: Some of the most effective suicide prevention programs to date are simple, efficient, and cost-effective but have not been widely tested or disseminated. For instance, one intervention involved simply sending supportive letters four times per year to randomly selected patients following hospital discharge; this significantly decreased the rate of suicide death among such patients (206). Moving forward, many such conceptual and methodological changes are needed in order to decrease the significant levels of death and disability caused by these dangerous behaviors.

Acknowledgements

Abbreviations

CDC

    Centers for Disease Control and Prevention

IQR

    interquartile range

SSRIs

    selective serotonin reuptake inhibitors

WHO

    World Health Organization

WISQARS

    Web-based Injury Statistics Query and Reporting System

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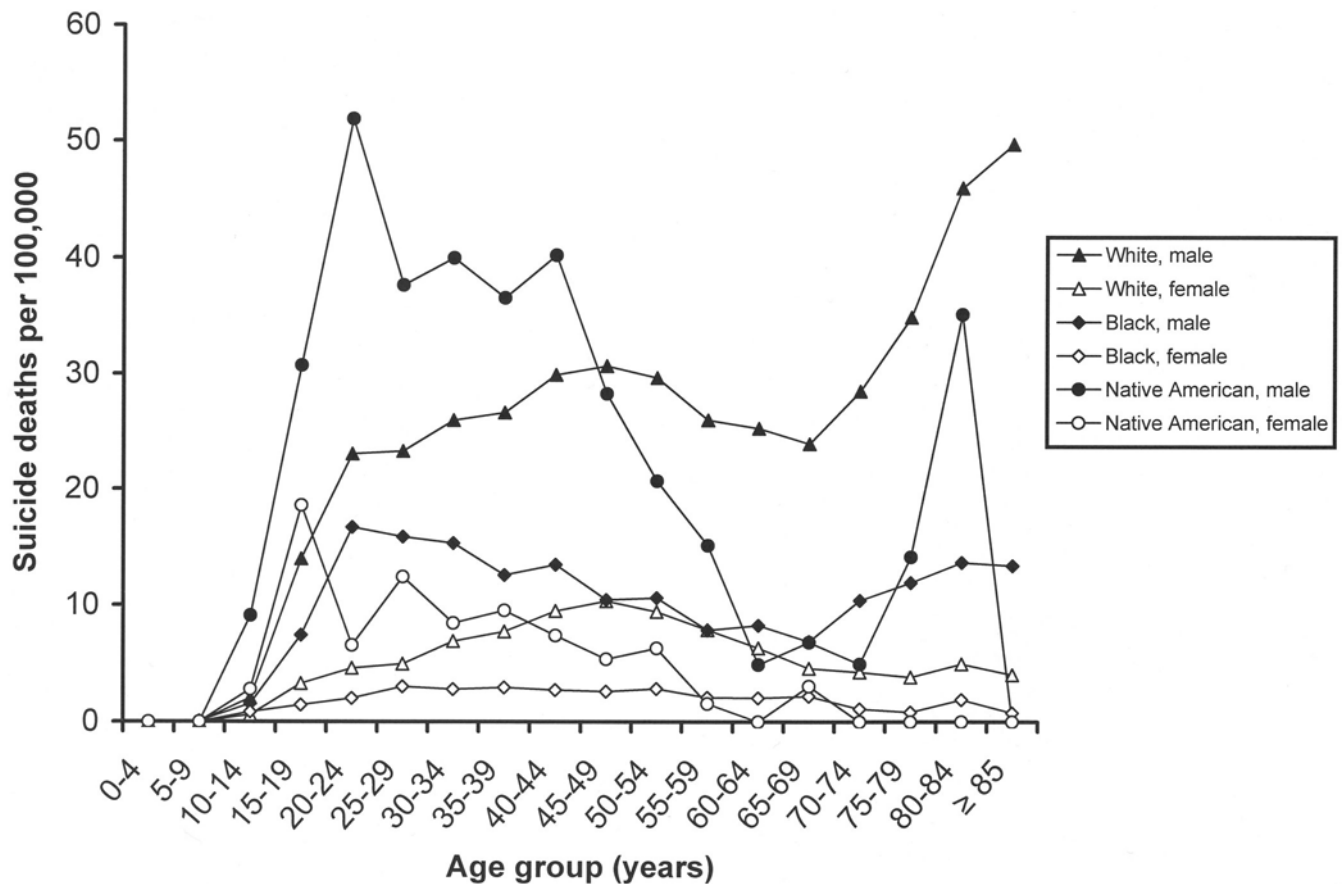
FIGURE 1.
Numbers of suicide deaths in the United States, by race/ethnicity, sex, and age group, 2005. Data were obtained from the US Centers for Disease Control and Prevention's Web-based Injury Statistics Query and Reporting System (WISQARS) (36). Data points based on fewer than 20 deaths per cell may be unreliable. These include those for persons under age 10 years for all groups, those for persons aged ≥80 years for Black males, those for persons aged 10–14 years and ≥55 years for Black females, those for persons aged 10–14 years and ≥45 years for Native American/Alaskan Native males, and all points except those for persons aged 10–14 years for Native American/Alaskan Native females.
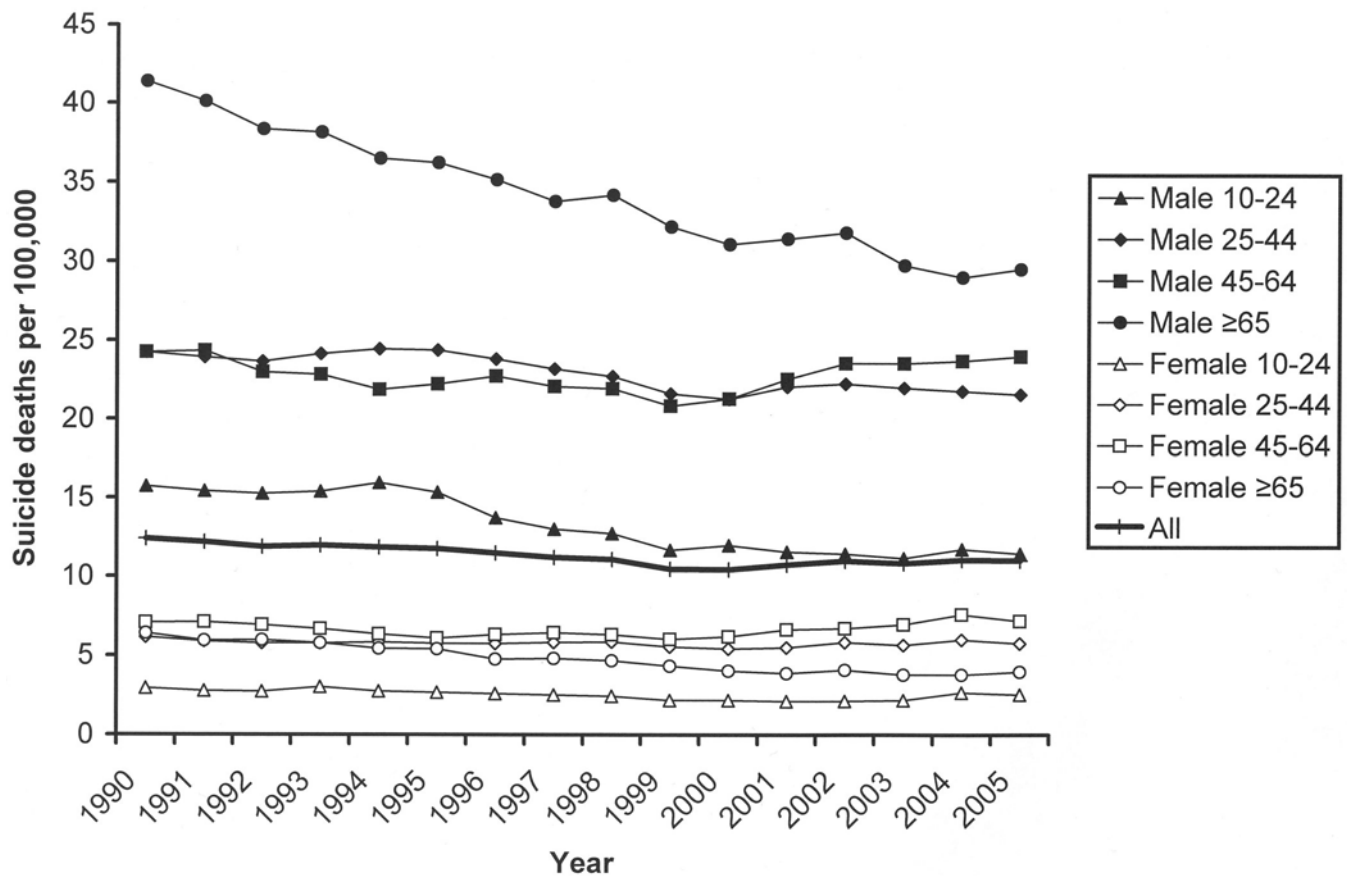
FIGURE 2.
Numbers of suicide deaths in the United States, by sex, age group, and year, 1990–2005. Data were obtained from the US Centers for Disease Control and Prevention's Web-based Injury Statistics Query and Reporting System (WISQARS) (36).
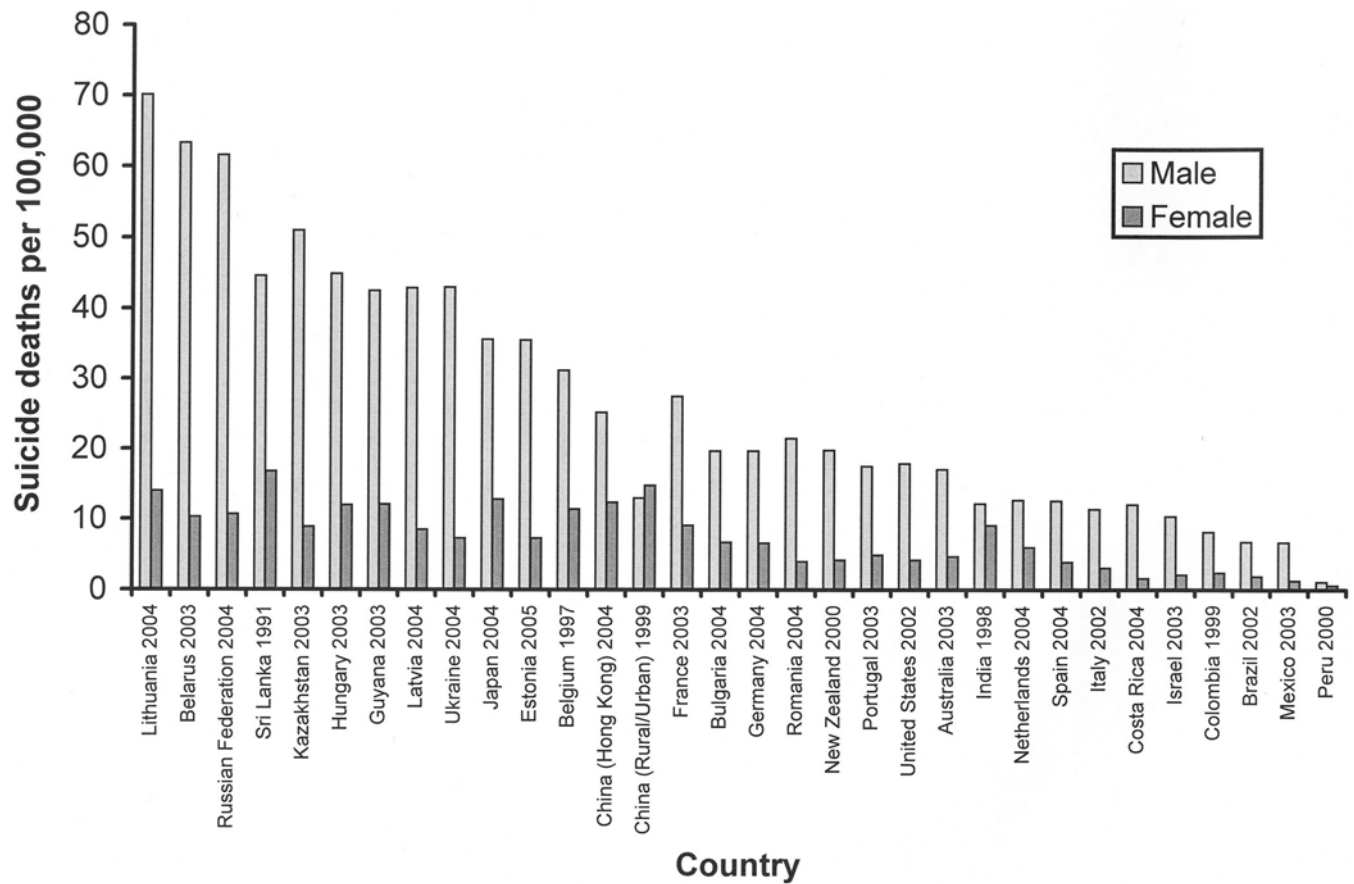
FIGURE 3.
Numbers of suicide deaths in numerous nations, for the most recent year available. Data were obtained from the World Health Organization (8).

FIGURE 4.
Rates of nonfatal self-injury in the United States, by sex and age group, 2006. Data were obtained from the US Centers for Disease Control and Prevention's Web-based Injury Statistics Query and Reporting System (WISQARS) (37). Data points for persons under age 10 years were based on relatively few cases and may be unreliable.
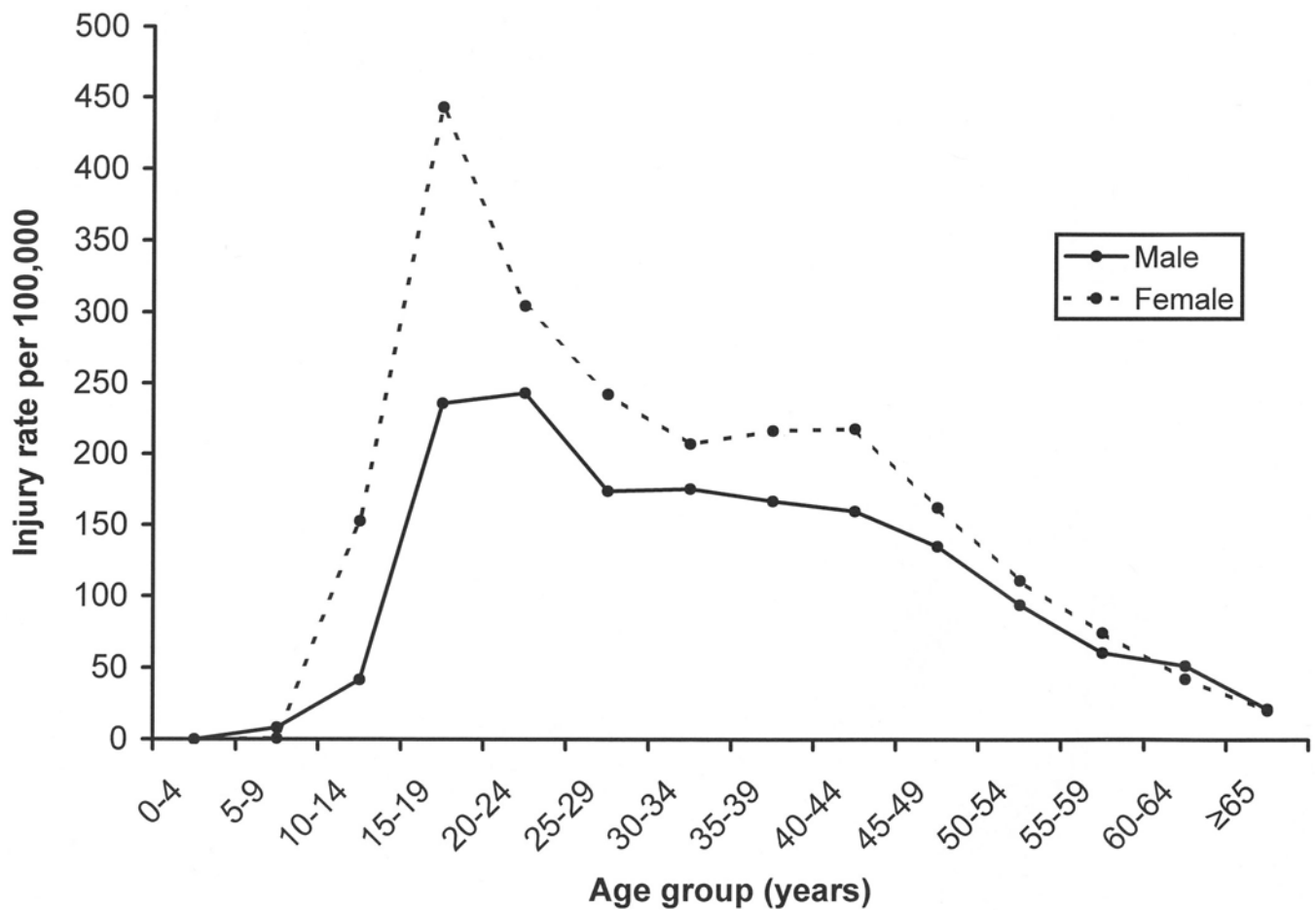
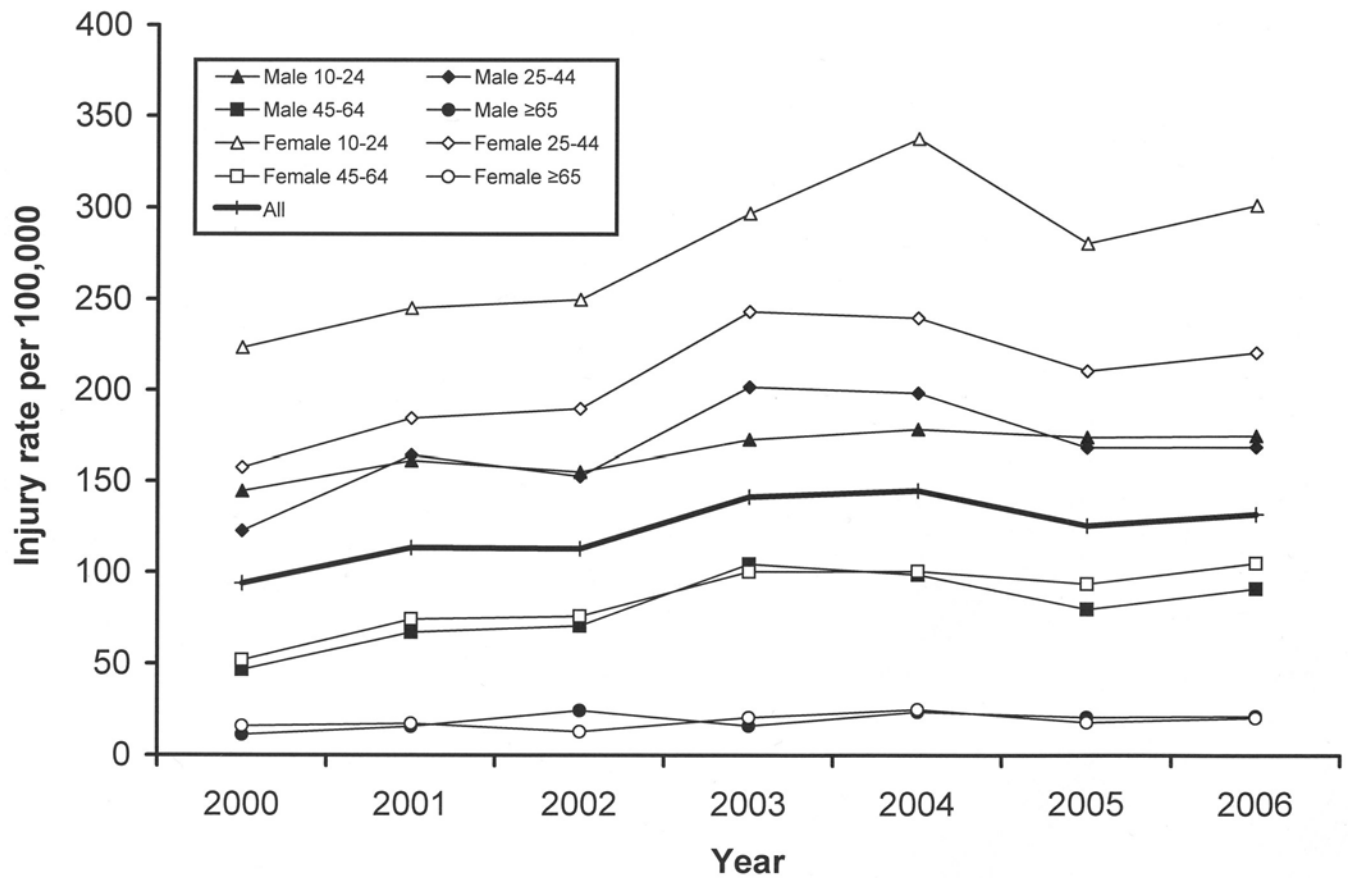**FIGURE 5.**
Rates of nonfatal self-injury in the United States, by age group, and year, 2001–2006. Data were obtained from the US Centers for Disease Control and Prevention's Web-based Injury Statistics Query and Reporting System (WISQARS) (37).

Table 1

Results from key studies on the prevalence of suicidal behavior, 1997–2007

Study (reference no.)	Location and study design	Sample (ages of participants)	Prevalence estimate (%)
US studies—adults (n = 11)			
Kessler et al., 1999 (47)	Nationally representative sample	5,877 adults (15–54 years)	Lifetime ideation: 13.5; Lifetime plans: 3.9; Lifetime attempts: 4.6
Dube et al., 2001 (207)	Primary care clinic in San Diego, California	17,337 adults (mean age = 57 years; standard deviation, 15.3)	Lifetime attempts: 3.8
Kuo et al., 2001 (208)	Baltimore, Maryland, community population	1,920 adults for this follow-up study (at baseline, ≥18 years)	Lifetime ideation: 5.6; Lifetime attempts: 1.9
Ialongo et al., 2002 (209)	Baltimore, Maryland, metropolitan area	1,157 African Americans (19–22 years)	Lifetime ideation: 14.3; Lifetime attempts: 5.3*; 6-month ideation: 1.9*; 6-month attempts: 0.4*
Garroutte et al., 2003 (149); Joe et al., 2006 (210)	Northern Plains reservations; Nationally representative sample	1,456 American Indian tribal members (15–57 years); 5,181 African Americans (≥18 years)	Lifetime attempts: 8.7; Lifetime ideation: 11.7; Lifetime attempts: 4.1; 12-month ideation: 2.1; 12-month attempts: 0.2
Nock and Kessler, 2006 (34)	Nationally representative sample	5,877 adults (15–54 years)	Lifetime gestures (no intent): 1.9*; Lifetime attempts (with intent): 2.7; Lifetime total attempts: 4.6
Fortuna et al., 2007 (211)	Latino ethnic subgroups	2,554 Spanish- and English-speaking members of Latino ethnic subgroups	Lifetime ideation: 10.1; Lifetime attempts: 4.4
Brener et al., 1999 (212)	College student population	4,609 undergraduate and graduate students (≥18 years)	12-month ideation: approximately 10; 12-month plans: approximately 7; 12-month attempts: approximately 2
Kessler et al., 2005 (22)	Nationally representative sample	9,708 adults (18–54 years), surveyed either between 1990 and 1992 (T1; n = 5,388) or between 2001 and 2003 (T2; n = 4,320)	12-month ideation (T1): 2.8; 12-month ideation (T2): 3.3; 12-month plans (T1): 0.7; 12-month plans (T2): 1.0; 12-month gestures (T1): 0.3; 12-month gestures (T2): 0.2; 12-month attempts (T1): 0.4; 12-month attempts (T2): 0.6
Borges et al., 2006 (57)	Nationally representative sample	5,692 adults (≥18 years)	12-month ideation: 2.6; 12-month plans: 0.7; 12-month attempts: 0.4
US studies—adolescents (n = 6)			
Alaimo et al., 2002 (213)	Nationally representative sample	754 adolescents (15–16 years)	Lifetime ideation: 19.8; Lifetime attempts: 4.6
Eisenberg et al., 2003 (214)	Minneapolis/St. Paul, Minnesota, metropolitan area	4,746 adolescents (grades 7–12)	Lifetime ideation: 24.0
Waldrop et al., 2007 (215)	Household probability sample	3,906 adolescents (12–17 years)	Lifetime ideation: 23.3; Lifetime attempts: 3.1
ODonnell et al., 2004 (156)	Economically disadvantaged neighborhoods in Brooklyn, New York	879 urban adolescents (16–17 years)	12-month ideation: 15.0; 12-month plans: 12.6; 12-month attempts: 10.6
Centers for Disease Control and Prevention, 2007 (45)	Nationally representative sample (biannually 1991–2005, Youth Risk Behavior Survey)	Adolescents (grades 9–12) from whom data were biannually collected between 1991 (n = 12,272) and 2005 (n = 13,953)	12-month multiple attempts: 4.3; 12-month ideation (1991): 29.0; 12-month ideation (1993): 24.1; 12-month ideation (1995): 24.1; 12-month ideation (1997): 20.5; 12-month ideation (1999): 19.3; 12-month ideation (2001): 19.0

Study (reference no.)	Location and study design	Sample (ages of participants)	Prevalence estimate (%)
			12-month ideation (2003): 16.9
			12-month ideation (2005): 16.9
			12-month plans (1991): 18.6
			12-month plans (1993): 19.0
			12-month plans (1995): 17.7
			12-month plans (1997): 15.7
			12-month plans (1999): 14.5
			12-month plans (2001): 14.8
			12-month plans (2003): 16.5
			12-month plans (2005): 13.0
			12-month attempts (1991): 7.3
			12-month attempts (1993): 8.6
			12-month attempts (1995): 8.7
			12-month attempts (1997): 7.7
			12-month attempts (1999): 8.3
			12-month attempts (2001): 8.8
			12-month attempts (2003): 8.5
			12-month attempts (2005): 8.4
King et al., 2001 (216)	Four geographically and ethnically diverse regions (Connecticut, Georgia, New York, and Puerto Rico)	1,285 adolescents (9–17 years)	6-month ideation (among persons with no lifetime attempts)* 5.2 6-month attempts: 3.3*
	International studies—adults (n = 26)		
Statham et al., 1998 (63)	Australia, community (twin) sample	Adult twins (women, 27–89 years; men, 28–85 years) from an Australian twin panel first surveyed in 1980–1982 (n = 5,995)	Lifetime ideation (males): 23.8 Lifetime ideation (females): 22.2 Lifetime plans (males): 5.7 Lifetime plans (females): 6.2 Lifetime attempts (males): 1.7 Lifetime attempts (females): 3.0
Kebede et al., 1999 (217)	Addis Ababa, Ethiopia, nationally representative sample	10,203 adults (≥15 years)	Lifetime attempts: 0.9 Current ideation: 2.7*
Akyuz et al., 2005 (218)	Central Turkey, nationally representative sample	628 women (18–65 years)	Lifetime attempts: 4.5
Kjoller and Helweg-Larsen, 2000 (219)	Denmark, nationally representative sample	1,362 adults (≥16 years)	Lifetime attempts: 3.4 12-month ideation: 6.9 12-month attempts: 0.5
Ramberg and Wasserman, 2000 (220)	Stockholm, Sweden, general population and mental health-care staff	1,010 mental health-care staff (19–64 years); 8,171 persons from the general population (20–64 years)	Lifetime ideation (mental health-care staff): 42.8* Lifetime ideation (general population): 20.3 Lifetime attempts (mental health-care staff): 4.8* Lifetime attempts (general population): 3.6 12-month ideation (mental health-care staff): 7.7* 12-month ideation (general population): 7.3 12-month attempts (mental health-care staff): 0.2* 12-month attempts (general population): 0.4
Renberg, 2001 (221)	Northern Sweden, general population	521 adults (18–65 years) from 1986; 636 adults (18–65 years) from 1996	Lifetime ideation (1986): 33.3 Lifetime ideation (1996): 21.1 Lifetime plans (1986): 10.4 Lifetime plans (1996): 13.1 Lifetime attempts (1986): 2.6

Study (reference no.)	Location and study design	Sample (ages of participants)	Prevalence estimate (%)
			Lifetime attempts (1996): 2.7 12-month ideation (1986): 12.5 12-month ideation (1996): 8.6 12-month plans (1986): 4.2 12-month plans (1996): 4.1 12-month attempts (1986): 0.6 12-month attempts (1996): 0.2
Rancans et al., 2003 (222)	Latvia, general population	667 adults (≥18 years)	Lifetime ideation: 33.0 Lifetime plans: 19.5 Lifetime attempts: 5.1 12-month ideation: 21.3 12-month plans: 12.2 12-month attempts: 1.8
Crawford et al., 2005 (223)	England	4,171 adults (16–74 years) among representative samples of White, Irish, Black Caribbean, Bangladeshi, Indian, and Pakistani ethnic groups	Lifetime ideation: 10 Lifetime attempts: 3
De Leo et al., 2005 (224)	Queensland, Australia, nationally representative sample	11,572 adults (≥18 years)	Lifetime ideation: 10.4 Lifetime plans: 4.4 Lifetime attempts: 4.2 12-month attempts: 0.4
Mohammadi et al., 2005 (225) Agoub et al., 2006 (226)	Iran, general population Casablanca, Morocco, sample representative of urban general population	25,180 adults (26–55 years) 800 adults (≥15 years)	Lifetime attempts: 1.4 Lifetime attempts: 2.1 * 1-month plans: 1.0 * 1-month attempts: 0.8 *
Beautrais et al., 2006 (227)	New Zealand, nationally representative sample	12,992 adults (≥16 years)	Lifetime ideation: 15.7 Lifetime plans: 5.5 Lifetime attempts: 4.5 12-month ideation: 3.2 12-month plans: 1.0 12-month attempts: 0.4
Liu et al., 2006 (228)	Hong Kong, territory-specific representation	2,015 adults (20–59 years)	Lifetime ideation: 28.1 12-month ideation: 6.0 12-month plans: 1.9 12-month attempts: 1.4
Ovuga et al., 2006 (229)	Makerere University, Uganda	101 older students (23.5 years (SD[†], 5.0)) and 253 younger students (21.3 years (SD, 2.4))	Lifetime ideation (older students): 8.9 Lifetime ideation (younger students): 56.0
Tran Thi Thanh et al., 2006 (230)	Dongda district, Hanoi, Vietnam, general population	2,260 adults (≥14 years)	Lifetime ideation: 8.9 Lifetime plans: 1.1 Lifetime attempts: 0.4 12-month ideation: 3.3 12-month plans: 0.5 12-month attempts: 0.1
Bernal et al., 2007 (231)	Six European countries (Belgium, France, Germany, Italy, Netherlands, and Spain), all nationally representative samples	8,796 adults (≥18 years)	Lifetime ideation: 7.8 Lifetime attempts: 1.3
Bromet et al., 2007 (232)	Ukraine, nationally representative samples	4,719 adults (≥18 years)	Lifetime ideation: 8.2 Lifetime plans: 2.7 Lifetime attempts: 1.8 12-month ideation: 1.8
Gureje et al., 2007 (233)	21 out of 36 states of Nigeria	6,752 adults (≥18 years)	Lifetime ideation: 3.2 Lifetime plans: 1.0 Lifetime attempts: 0.7
Lee et al., 2007 (234)	Beijing and Shanghai, China, general population	5,201 adults (≥18 years)	Lifetime ideation: 3.1 Lifetime plans: 0.9 Lifetime attempts: 1.0

Study (reference no.)	Location and study design	Sample (ages of participants)	Prevalence estimate (%)
Nojomi et al., 2007 (235)	Karaj City, Tehran Province, Iran	2,300 adults (including as early as 15 years), attempt rate from pilot study	Lifetime attempts: 1.2
Borges et al., 2008 (236)	Mexico, nationally representative sample	5,782 adults	Lifetime ideation: 8.1; Lifetime plans: 3.2; Lifetime attempts: 2.7
Hintikka et al., 1998 (237)	Finland, general population	4,868 adults	12-month ideation (females): 2.4; 12-month ideation (males): 2.3
Scocco and De Leo, 2002 (43)	Padua, Italy, community-dwelling elderly population	611 older adults (≥65 years)	12-month ideation: 9.5; 12-month attempts: 3.8
Gunnell et al., 2004 (238)	United Kingdom, nationally representative sample	2,404 adults (16–74 years)	12-month ideation: 2.3
Fairweather et al., 2007 (239)	Australia	7,485 adults (cohorts of 20–24, 40–44, and 60–64 years)	12-month ideation: 8.2
De Leo et al., 2001 (60)	Sweden, France, United Kingdom, Denmark, Italy, Norway, Finland, the Netherlands, Germany, Switzerland, Austria, Spain, and Hungary	1,518 older persons (≥65 years)	Monitoring period of 3–5 years, at least one attempt: 0.06*
International studies—adolescents (n = 20)			
Olsson and von Knorring, 1999 (240)	Sweden (one town)	2,300 adolescents (16–17 years)	Lifetime attempts: 2.4
Elklit, 2002 (241)	Denmark, nationally representative sample	390 eighth-graders (mean age = 14.5 years)	Lifetime attempts: 6.2
Blum et al., 2003 (152)	Antigua, Bahamas, Barbados, British Virgin Islands, Dominica, Grenada, Guyana, Jamaica, and St. Lucia	15,695 adolescents (10–18 years)	Lifetime attempts: 12.1
Gmitrowicz et al., 2003 (242)	Lodz, Poland, community population	1,663 adolescents (14–21 years)	Lifetime ideation: 30.8; Lifetime attempts: 7.9
Toros et al., 2004 (243)	Turkey	4,143 children and adolescents (10–20 years)	Lifetime attempts: 1.9
Zemaitiene and Zaborskis, 2005 (244)	Lithuania, nationally representative sample	15,586 children (11, 13, and 15 years)	Lifetime plans: 3.0
Young et al., 2006 (245)	Central Clydeside Conurbation, Scotland, community population	1,258 older adolescents (19 years)	Lifetime attempts: 1.5
Sidhartha and Jena, 2006 (246)	New Delhi, India, student population	1,205 adolescents (12–19 years)	Lifetime attempts: 6.4
Dervic et al., 2007 (247)	Vienna, Austria, student population	214 adolescents (15.6 years (SD, 1.4))	Lifetime ideation: 21.7; Lifetime attempts: 8.0; 12-month ideation: 11.7; 12-month attempts: 3.5
Silviken and Kvernmo, 2007 (248)	Arctic Norway, representative samples of different ethnic groups	591 indigenous Sami adolescents and 2,100 majority adolescents (16–18 years)	Lifetime ideation: 37.9; Lifetime attempts: 9.5 *
Rey Gex et al., 1998 (249)	Switzerland, nationally representative sample	9,268 adolescents (15–20 years)	6-month ideation: 15.1 *; 12-month ideation: 26; 12-month plans: 15; 12-month attempts: 3
Tousignant et al., 1999 (250)	Canadian sample of refugees from 35 countries	203 adolescents (13–19 years)	12-month attempts: 3.4
Miauton et al., 2003 (251)	Switzerland, nationally representative sample	9,268 adolescents (15–19 years)	12-month attempts: 3.0
Yip et al., 2004 (252)	Hong Kong, territory-specific representation	2,586 adolescents (13–21 years)	12-month ideation: 17.8; 12-month plans: 5.4; 12-month attempts: 8.4
Rodriguez et al., 2006 (253)	Nicaragua, general population	278 adolescents (15–24 years)	12-month ideation: 19.8; 12-month plans: 5.0; 12-month attempts: 1.8
Rudatsikira et al., 2007 (254)	Guyana, student population	1,197 adolescents (<14–≥16 years)	12-month ideation: 18.4
Kaltiala-Heino et al., 1999 (255)	Two regions of Finland, student population	16,410 adolescents (14–16 years)	Current ideation: 2.2 *
Khokher et al., 2005 (256)	Karachi, Pakistan, medical student population	217 medical students (19–22 years)	Recent ideation: 31.3 *
Liu et al., 2005 (257)	Shandong, China (five high schools)	1,362 adolescents (12–18 years)	6-month ideation: 19.3 *; 6-month attempts: 7.0 *
Ponizovsky et al., 1999 (258)	Israel, immigrant population	406 Russian-born Jewish immigrants to Israel (11–18 years); 203 indigenous Jewish adolescents in Russia; 104 Indigenous Jewish adolescents in Israel	6-month ideation (immigrants): 10.9 *; 6-month ideation (Russian natives): 3.5 *

Study (reference no.)	Location and study design	Sample (ages of participants)	Prevalence estimate (%)
			6-month ideation (Israeli natives): 8.7*
	Cross-national studies (n = 3)		
Weissman et al., 1999 (26)	Nine countries, varying designs and surveys	Approximately 40,000 adults	Lifetime ideation (range): 2.1–18.5 Lifetime attempts (range): 0.7–5.9
Bertolote et al., 2005 (27)	10 countries, same community-based survey in 10 hospital catchment areas	69,797 children, adolescents, and adults (≥5 years)	Lifetime ideation (range): 2.6–25.4 Lifetime plans (range): 1.1–15.6 Lifetime attempts (range): 0.4–4.2
Nock et al., 2008 (25)	17 countries, same household survey; most samples were nationally representative	84,850 adults	Lifetime ideation (range): 3.0–15.9 Lifetime plans (range): 0.7–5.6 Lifetime attempts (range): 0.5–5.0 Lifetime ideation (pooled): 9.2 Lifetime plans (pooled): 3.1 Lifetime attempts (pooled): 2.7

* Not included in prevalence estimates in text because of differences in measurement.

† SD, standard deviation.